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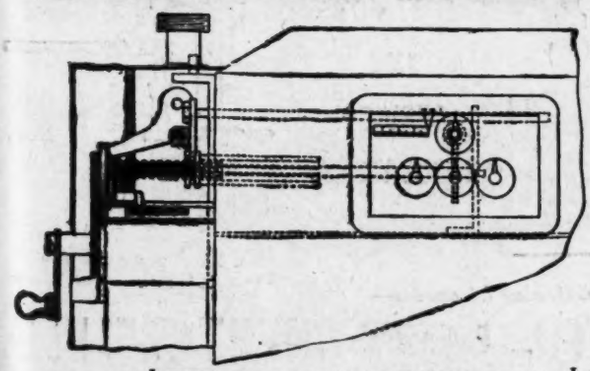

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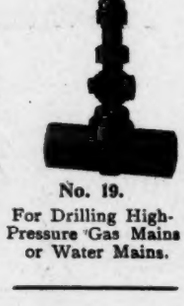

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VOL. CXXXVIII., No. 2818.] TUESDAY, MAY 15, 1917. [69TH YEAR.

EDITORIAL NOTES.

Lord Moulton to be President of the Institution of Gas Engineers.

THE Institution of Gas Engineers is to have a distinction conferred upon it during the coming year which will give immense gratification not only to the members of that body, but to the gas industry generally. The Right Hon. Lord Moulton, K.C.B., F.R.S., has accepted the double honour the Council tendered him of honorary membership and the presidency for the year 1917-18. Both the honorary membership and the tenancy of the Presidential Chair will keep his Lordship's name permanently identified with the industry's technical organization; but his presidency will make next year a red-letter one in its annals. It is safe to say that in no industry has Lord Moulton greater admirers, for his high scientific and forensic attainments and other personal qualities, than in that devoted to the provision of gas and other products for urban and industrial purposes; and this admiration has grown during the period that he, as Director-General of Explosives Supplies, and the gas industry have been closely allied in the work of putting this country and her Allies beyond the reach of disaster through lack or shortage of high explosives. From a perilous position, the goal of safety in this respect has been reached, though a still greater margin is wanted, and the work will only end with the declaration of peace. Of the industry's efforts in this direction, the acceptance by his Lordship of the presidency of the Institution is a token of a great appreciation, which is supplemented by the words: "I can safely "say that the assistance rendered me in the arduous task "which was before me has been of the highest service to "the State, and of incalculable value to the success of our "arms." From this, it is clear that Lord Moulton is to day much easier in his mind as to the work of his department than he was when he entered upon it. We hope his year of office as President of the Institution will see the end of the necessity for this work through the complete victory of this country and her Allies. The honour that Lord Moulton is doing the Institution will push back one year farther the dates when Mr. Samuel Glover and Mr. Thomas Berridge will reach the chair; but they will count it a small delay in view of the gain which causes it.

Headquarters for the Gas Industry.

EVERY industry is setting its house in order for the work that is coming after the war. In creating a National Gas Council, the gas industry has put its organization on the high road to the consummation of a properly representative Association for the whole of its elements; but the industry has no home. It is largely dependent upon others more fortunate, and for the rest is a paying tenant for indifferent accommodation. The industry in its organization is stronger to-day than it was a year ago; and it is felt that some real preliminary steps should now be taken towards realizing the ambition of getting a home that, while helping in the work of the industry, shall be representative and worthy of its status and extensive activities.

The Council of the Institution of Gas Engineers have issued circulars on the subject, which show the existence of an influential Building Committee, consisting of Presidents and Councils of the various gas organizations and a substantial list of men in high place in the administrative, technical, and commercial work of the industry. This membership indicates that opinion is widespread that the suggested preliminary action should be taken—that is, to secure a site for a building, to have plans prepared, and to consider the question of how best to raise the necessary funds, though, of course, nothing can be done in the way of actual building until after the war. The fund of £632 which the Institution had in hand last December will not go far towards the object in view, as the scheme which the circular pictures is a full one. This is as it should be; for while the industry is going in for a central home, it should be one that will be suitable not only for present service, but for the expanded future work that it is patent is opening up to the industry. It would, indeed, be a pity to spoil the scheme by considering how little will answer present purpose; consideration should have before it the maximum possible serviceableness, without extravagance. The building should be one that would be available for all the organizations of the industry, and for their meetings and conferences; it should be revenue producing for arbitrations and gas shareholders' meetings; and the circular suggests other lines of utility connected with conference, inquiry, and research. From every point of view, we are glad to see the Council of the Institution have adopted the maxim that "if the thing is worth doing at all, it is worth "doing well."

There is one suggestion we should like to make to the Institution Council. It is that, in handling this important matter—all praise to them for taking it up—they will do much better to encourage the idea that it is a central home for the "industry," and that there are going to be no "top dogs" in connection with it. In one place it speaks of a central home for the "industry;" but another paragraph reads: "There can be no doubt that when the "*Institution* enters into possession of a building *of its own*, "it will enable the work of the gas industry to be more "vigorously advanced than has been possible hitherto." We suggest that the word "Institution" should be "industry," and that when, in time, the "home" is established, the property should be vested in trustees for the industry. The major part of the money required for the building will not be provided personally by the members of the Institution, but by the industry generally. The funds will be obtained much quicker if the notion of headquarters for the industry is kept in the ascendant. Having for long years advocated the provision of a central home, the "JOURNAL" may be relied upon to give the scheme all the aid within its power.

An Appeal to the Gas Industry and to the Public.

EVENTS move quickly. In the "JOURNAL" last week reference was made in an editorial article to the need for gas coal economy, so far as is possible, by having recourse to the dilution of coal gas by blue water gas; and, alluding to certain remarks that Mr. Thomas Glover, the Gas Engineer Adviser to the Coal Controller, had made at the Eastern Counties' Association meeting, it was suggested that it might be deduced from them that the gas industry would soon have from the Coal Controller a recommendation that economy by dilution should be pursued, in order to contribute to the general saving of coal and to the lightening of the pressure upon the railways. While the article was being distributed through the post, the Council of the Institution of Gas Engineers had before them an appeal from the Coal Controller on the lines indicated, with a request that it should be brought before the gas industry. The need for doing something in this way, Mr. Guy Calthrop declares, is "urgent;" and he would not say this without cause. He is too practical to be an alarmist. What he asks is that there shall be substitution for coal gas of blue or

lightly carburetted water gas, and that the substitution shall be carried out to the greatest practicable extent, consistent with the requirements of the Ministry of Munitions, and the adaptability of the mixed coal and water gas for the industries using gas for special fuel and lighting purposes. The Coal Controller is advised that from 10 to 25 p.ct. of uncarburetted gas and a higher percentage of lightly carburetted water gas can be added to the coal gas. The importance that the Controller places upon this matter is plain from the terms of his communication. [See p. 281.]

In his recommendation, the Controller uses the words "consistent with the requirements of the Ministry of Muni-"tions." There is really nothing in what he suggests that is antagonistic to the needs of the Ministry of Munitions. As a matter of fact, with the two departments working in unison, the one can, through gas-works, help the other, though at first sight the Coal Controller's urgent appeal to economize, by the means indicated, the use of coal for gas making appears to be hostile to an appeal published by the Ministry of Munitions in the Daily Press on Friday last, impressing upon the public the desirability of limiting in every way possible the consumption of raw coal for industrial and domestic purposes, and to use gas or coke, in order that recovery may be made of the bye-products of the carbonization of coal which are essential for munitions of war and for the production of food. So far so good. But we do not quite understand what "efforts are being made," in association with the difficulty of meeting all demands for coke, "to enable gas-works to consume a smaller proportion than "hitherto for their own requirements," nor how it is hoped that "in this way" the supply available for the public will be substantially increased. To the extent that the recommendation of the Coal Controller is adopted, coke will be required for the making of blue or lightly carburetted water gas. But *per contra* the coal gas displaced by this means will lessen the amount of coke required as producer fuel in the retort-settings. That the objects of the two departments have a definite relationship is clear. The mixing of blue water gas with coal gas may necessitate a lowering somewhat of the amount of the latter produced per ton of coal so as to realize a higher quality of gas; but this would not interfere with the yields of benzol per ton of coal used, as it is not at the tail-end of a long duration charge, carbonized at high temperature, that the hydrocarbon vapours required by the Ministry of Munitions are formed. The mixing with the higher quality coal gas of a percentage of blue water gas would give a high production of good combustible gas from a ton of decent gas coal and (say) under 1 cwt. of coke. By the encouragement of the Ministry of Munitions to householders and manufacturers to burn more gas, a portion of the coal that they destructively use for heating purposes only will provide additional quantities of gas and coke, besides crude benzol, sulphate, &c. It is easy to see from this how, while the letter from the Coal Controller to the gas industry and the request of the Ministry of Munitions to the public may, set side by side, appear at first to be diametrically opposed, when closely examined they are found to be actively reciprocal in serving the aims of both departments, as well as, through the larger provision of sulphate of ammonia, one of the present objects of the Board of Agriculture.

Since the subject of dilution of coal gas by blue or lightly carburetted water gas has been under discussion in our columns, we have been favoured by correspondents with some interesting and informative private communications relating to it. One of the latest of these states that years ago the writer made highly carburetted water gas, and mixed it with the coal gas in the holders. The result was not by any means satisfactory. But necessity arising from difficulties in obtaining coal, oil, and labour caused trials with the introduction of about 25 p.ct. of lightly carburetted water gas—about ½ gallon of oil being used per 1000 c.ft. of gas made. This gas has been introduced into the foul gas main, where it acts as a vehicle for picking-up hydrocarbons that would otherwise condense out with the tar. This reminds of a point recently mentioned by Mr. W. R. Herring. He, while admitting that the hydraulic or foul main was the best point at which to introduce the blue water gas, raised the question whether this source would reduce the quantity of benzol, &c., recovered. We are looking forward to receiving from him the results of a large-scale experiment in which the water gas is admitted after the oil-washers and before the purifiers. That by the way. Our correspondent, to whose experiences with carburetted water gas we were referring, has found no inconvenience from the use of the slightly carburetted water gas, "beyond the adjustment of "burners required by the slightly diminished calorific value "of the gas; but it must be remembered that the coal gas "with which we mix is of the good old-fashioned sort. I "can assure you that one of the most successful and best "managed companies in this county for years has been introducing blue water gas up to 15 and 20 p.ct. on the lines "described, without any adverse effect. Properly applied, I "think the mixing of blue water gas and good coal gas at "the present time is the right thing from the national point "of view." When the writer speaks of "good coal gas," the rest of the letter shows that he is alluding to coal gas containing no inert gases beyond what is unavoidable.

Avoidable Adulteration.

There is gratifying evidence that, through the articles and correspondence that have appeared in our columns, interest has been largely aroused in the companion questions of adulteration of town gas by incombustible constituents and of dilution by combustibles. Regarding the latter, there is a development, emanating from the Coal Controller, which is dealt with in the preceding article. As to adulteration by inert gases, there has been occasion to write very pointedly. Duty demanded; for the interests of the whole gas industry cannot be permitted to be jeopardized or sacrificed by those persistent blunderers in our midst who are without apparent sense of responsibility even in respect of the interests of their own undertakings. We make no apology for the part the "Journal" has taken in this matter. It was within our knowledge that the whole industry was being run into a dangerous position through the imprudent action of the managers of a number of undertakings, that irrefragable evidence of the malpractice is being systematically accumulated, and that this evidence is for the purpose of securing from Parliament further restrictive enactment. If honesty and a care for reputation had prevailed, nothing of this kind could or would ever have happened. Only from one or two quarters has there been any inkling of disapproval of what the "Journal" has been doing in this matter. We are not in the least concerned. Our interest is with those undertakings which are supplying gas containing the lowest possible quantity of inert ingredients, but which will also have the penalty of the misdoings of others placed upon them unless immediate reform on the part of the latter, and the establishment of a better record, give satisfaction. To those who are inclined to resent the open course we have pursued, we can well reply that the very act of disapproval would be indicative of something that is not pleasant. The facts are too widely known and too well-founded to have admitted of any covert means being usefully employed with the view to inducing reformation. Indeed, we regretfully doubt whether any such means would alone have brought about the desirable conversion to honest dealing as between supplier and buyer. Only publicity and the menace of legislative enactment will in some cases prove effective.

In taking the line we have done against a destructive policy, there have been large interests to serve—present and future; and to sit by quietly and know that this future was being marred by those whose thoughts were only concentrated on current advantage was not to our mind the correct thing. It has been a pleasure to receive, in connection with this matter, expressions of approbation from several quarters, and of a desire that, until the industry is freed from the nocuous practice, the matter shall be perseveringly and unhesitatingly followed up. By some of those engineers who have privately communicated with us on the subject, the act of avoidable adulteration has been described as "dishonest," "immoral," and "disgraceful;" and there have been others equally expressive. One correspondent says that makes inflated by inert gases are merely "for the sake of gratify-"ing some one's self-conceit, at the expense of both con-"sumer and the gas industry generally;" while another engineer says "the practice is pursued with the object of "running through the consumers' meters something that is "of no use to him, but the contrary, and for which he has to "pay." It does not require a meter running fast to cause a consumer to pay more than is due from him when it is possible to employ the crafty and discreditable means against which the preliminaries of a systematic crusade are now well under way. However, it is something to be thankful for that those guilty of the practice of avoidable adulteration have against them an overwhelming majority of gas under-

takings that can and do send out an honestly constituted commodity. We would sooner have such a commodity of 450 or 460 B.Th.U. than one of 500 B.Th.U. that contained a high percentage of nitrogen, thus depreciating flame temperature by large flame volume and therefore cooled surface, together with the heat-absorbing addition to the stream of products of combustion. However, the matter of town gas adulteration is being seriously taken in hand within the industry; but our regret is that it was not dealt with before certain important external bodies got on to the track of the abuse of privilege. Still, better present publicity and difficulty than permanent degradation of the interests of the industry. We wonder if there is any association between this subject and the grant of £450 by the Council of the Institution of Gas Engineers to the Gas Lighting, Heating, and Ventilating Committee to enable them to undertake some "important work which requires "immediate attention in the interests of the gas industry."

Wartime Works Alterations at York.

ON reading the paper that Mr. H. E. Bloor, the Engineer and Manager of the York Gas Company, presented at the meeting of the North of England Gas Managers' Association, there will be gas engineers who will be envious of his good fortune in having succeeded in getting so much work as he described accomplished during the war, but at the same time will congratulate him upon the fact. The proprietors of the York Gas Company, too, must consider themselves fortunate that the modernizing work and equipment were resolved upon at such an early period in the war, as, had there been procrastination, they would have found themselves to-day in a very difficult position, from which there would have been but partial escape, and chained to an uneconomy which at any time is bad, but would have been disastrous in these times of heavy costs and a war-enforced curtailment of liberties in every direction. However, it must have been a great disappointment to Mr. Bloor that the war intervened, and prevented him carrying out a bold scheme of reconstruction which would in time have meant for his Company, practically speaking, a new and modern works. That scheme—it is hoped only temporarily—culminated in plans. But something had to be done without delay. The York Gas-Works appear to have been living in perfect harmony with the historic character of the city. When Mr. Bloor took charge of them, he found they were standing memorials to a long past gas technic, necessitating much labour per unit of gas production, and generally uneconomical—in notable respect we should imagine in regard to fuel.

With the outbreak of war, the Directors took the view that the quickest road to achieve something beneficial was to adopt an alternative and less extensive scheme of improvement of the existing works, also as suggested by their Engineer. They were wise; and events have proved the accuracy of their determination. They foresaw a prolonged war, labour becoming scarcer and scarcer, materials more difficult to procure, and a financial situation which would become progressively more stringent. What they foresaw is here to-day; the much modified alternative scheme of improvement is now lending its aid—and valuable aid it is—in ameliorating the current difficult circumstances. But while the work of improvement by adaptation that has taken place under Mr. Bloor's advice and plans has done so much towards realizing economies, the works as they stand, in no wise, represent what he as a progressive gas engineer would wish them to be. They merely represent the best that he could make, under the pressure of necessity, of the conditions existing when he executed the work.

The details of what was done are found in Mr. Bloor's paper, with explanatory reasons and comments interspersed. The outstanding features are the De Brouwer retort plant and the coal and coke handling arrangements. As part of the coke-handling scheme, special interest attaches to the elevated electric railway running through the retort-house, across the coke-yard, and into the coal-store, where the railway trucks are filled with coke. It is, of course, impossible, in present times, to give any reliable operating costs. But perhaps, some day, Mr. Bloor may be prevailed upon to supply such costs, and a more detailed account of the work done by this electric railway, so that those employing the telpherage system may have an opportunity of making comparisons, as approximate as diversity of conditions will allow; and such comparisons would then enable Mr. Bloor to see what he is likely to have lost or gained by not, through his circumstances, being in the position to adopt the telpher system, as he would have liked to have done. Among the disadvantages which he suffers is that he is compelled to use cold coke for his producers. These are days when we are talking of fuel economy; and it must be a matter of regret to any gas engineer who cannot use in his producers the thermal value of incandescent coke direct from his retorts, instead of losing heat by quenching, and again requiring an expenditure of heat in raising to incandescence the cold coke.

Debenzolizing Oil and Dehydrating Tar in Small Works.

THE principal value of the paper that Mr. E. F. Keable read at the recent meeting of the Eastern Counties Gas Managers' Association is found in the further testimony that it affords of the fact that oil-washing of gas for the extraction of crude benzol is not a process having exclusive application to large works. It is also useful in that it shows how the tar-dehydrating plant at the Gorleston Gas-Works has been adapted to the debenzolizing of wash-oil, and can now be employed for the one purpose or the other at will, which is a point of importance for a works with a demand upon it for dehydrated tar for road use. Prior to the war, the gas industry on its technical side was not very favourable to an extension of its processes, though willing enough, when opportunity has permitted, to introduce new methods within the confines of the old workings. But the need for benzene, toluene, and other things with which the industry is in a position to oblige the country, has broken through the long-established and generally, though not universally, observed bounds. What is more, it has been a comparatively easy matter to do this. There have been difficulties which have been, or are being, overcome; but now, even from little Gorleston, we read: "The plant has become to "us so much a part and parcel of our ordinary routine, that "we have almost forgotten its advent is of recent date." This being so, it is about time that discussions should be relieved of some of the elementary principles associated with oil-washing—such as the need for wash-oil with low naphthalene content, the necessity for closely watching the relations of the temperatures of the gas and oil so as not to get any reversal of the sought effects, and so on. The rules for good working are really simple; the maintenance of the conditions is the matter that claims frequent observation.

So far in his results, Mr. Keable has done remarkably well, and has been free from trouble. But whether he will continue to be so is another matter, unless he protects himself against changing temperature circumstances. His working results are equal to 2 gallons of crude benzol per ton of coal carbonized, with a reduction of only 5 per cent. in the calorific power of the gas. The results are good; but there is nothing unique about them, as some of the speakers seemed to indicate. Other men in other places working on a larger scale have got results of a similar character. There was surprise expressed that, with a 2-gallon extraction, the calorific power was not affected to a larger extent. We do not see why this necessarily should be, seeing that Mr. Keable confesses his condensation is not all it should be; and therefore (as Mr. W. W. Townsend pointed out) some of the benzene which should with efficient condensation be found in the tar is left to be extracted from the gas, so giving an efficiency to the oil-washing process which it would not achieve were the condensation of a healthier order. If more benzene was found in the tar, there would be less in the wash-oil per ton of coal carbonized; and therefore it does not necessarily follow that the reduction of calorific power mentioned in the paper is an underestimate. However, Mr. Keable will now probably be strengthening his condensing power during the summer; and it will be interesting to subsequently have his results over a period corresponding with that mentioned in the paper. It would also be useful to have an analysis of the tar while he is realizing the result of 2 gallons of crude benzol per ton of coal, as well as later of the tar under improved condensing conditions. Speaking of summer time, a common defect in connection with the oil-washing process is the insufficiency of the cooling arrangements provided by the makers of the plant. Complaint of this is being constantly met with; and makers would do well to provide a sufficiency at first, for it only means rectifying the deficiency later on. Experience of difficulties and errors and result

improving methods and wrinkles are the things that are more useful in discussions on this subject than elementary principles of which all adopting the process should from the outset be cognizant, unless they intend to court failure. And that is the direction in which it is hoped discussion will in future be pursued. It has been mentioned that the creosote oil used at Gorleston has a low naphthalene content. This is a confirmation of the advantage of small gas undertakings adopting the process being in the neighbourhood of large gas undertakings carrying on business as tar distillers. The wash-oil in the Gorleston instance is supplied from the Norwich works of the British Gas Light Company, who are in turn buyers of the crude benzol. Thus Gorleston and Norwich are both satisfied.

There was a point raised by the President (Mr. John Terrace) in the course of the discussion which cannot pass without brief allusion. He was referring to the means adopted by Mr. Keable for regulating the quality of his gas; and this led him to the subject of gas adulteration by putting in furnace gases. In this connection he made an obvious slip. "We are told," he said, "that we must save "all the coal we can; but it would hardly be conducive "to that end if we suddenly dropped from 12,500 c.ft. "per ton to 11,500 c.ft., because it was discovered we "had more diluents in the gas than we should have." A greater fallacy Mr. Terrace never breathed. He misused the word diluents; he meant adulterants. Adulterants are not of the slightest value to gas consumers—in fact, they are a detriment; and the larger their proportion, the more probable it is that, to get the amount of heat from the gas that the consumers require, more coal has to be carbonized than would otherwise be the case. If Mr. Terrace has studied the effect of inert gases on flame temperature, he will immediately realize that the delivery of incombustibles to gas consumers is not conducive to the saving of coal, nor is such delivery putting to the maximum beneficial use gas-works plant and mains. But Mr. Terrace relieves criticism to an extent by agreeing that large makes of gas per ton have been pushed too far—much too far, judging from the results of analyses of not a few makes of gas.

The Position of Non-Certified Undertakings.

We are informed by the National Gas Council that, according to the latest interpretation of the recruiting position, undertakings which are not "certified" by the Ministry of Munitions are still protected, as formerly, by the list of Reserved Occupations R117, whereby all men employed inside gas-works, and men engaged in the maintenance and upkeep of plant on the district, were exempt from military service, but that this list is in course of revision and a new edition will shortly be issued. This should allay all immediate anxiety on the part of undertakings that have not secured certification.

The Interminable Criticism of the "Refractory" Makers.

The makers of refractory materials will begin to wonder when they are going to get free from the cuffings that all and sundry appear to think it a duty to administer for their alleged want of scientific practices and their adhesion to empirical methods. Such treatment commenced in the gas industry; it had good effect. It has since been continued at meetings of the technical men of the coke-oven industry; at a conference convened by the Faraday Society; and now at the recent meeting of the Iron and Steel Institute. There was a perfect avalanche of condemnation there; and Prof. W. A. Bone, of the Imperial College, and Prof. Arnold, of the University of Sheffield, spoke of the scientific investigation that is being bestowed on refractories in Germany and America. This country stands in the shade in the matter; but Prof. Arnold related an experience with German and British made fireclay bricks which shows that—science or no science—our British makers can, when put on their mettle, turn out fire-bricks that equal those of German origin. So far this is satisfactory; but some concerted attempt should be made by the makers to put themselves beyond this ever-recurring reproach. Mr. Cosmo Johns, who opened the discussion at the Iron and Steel Institute, referred to the excellent example of the gas industry in issuing specifications for its refractory materials. He thinks this is an example that might be emulated in other industries. But such specifications, he remarks, should only be the starting-point for systematic and detailed research. The question arises, Are we going the right way to work in this research on refractories? There was much talk at the Faraday Society about co-ordinating the research. But we find independent work going on at the Leeds and Sheffield Universities, at the Imperial College, the National Physical Laboratory, at the Stoke-on-Trent Laboratories, and at other places. It is good to find such widespread interest being taken; but, if there were co-ordination, and special lines of work allocated to the different centres, would not brains, time, and money be employed with a larger and more valuable result?

There's Nothing Like Tar.

The technical men of the gas industry are well acquainted with the tar tree with its multitudinous branches each representing some serviceable derivative from coal tar; and no one can say what further discoveries research, through synthesis, catalysis, or in other ways, may bring forth from the same wealthy source. Tar has conferred many blessings on mankind; but, in helping in the alleviation of suffering and the healing of wounds, it has now surpassed its former self. An application came before the Patents Court the other day [the proceedings are reported in our "Legal Intelligence"] in connection with the use of a German patent for a substance known as "Flavine," which belongs to the acridine group. Medical reports ascribe to it powerful bactericidal and antiseptic properties, and striking instances are given of cures. A large number of cases of shrapnel wounds have been treated, some 6 in. square, with successful results; and one is mentioned where a piece of skin the size of a man's hand was torn from a scalp, and was entirely healed in five days by the new specific. Consideration is being given to the advisability of granting without royalty licences for the manufacture of this valuable substance, for which a new name is to be found. The gas industry provides the materials for high explosives; and will be gratified that it is the source of a specific of such notable virtue.

Inflated Coal Dividends.

The reference in our issue for May 1 [p. 180] to the admissions of the "Iron and Coal Trades Review" regarding those virtuous coal owners who in their dealings have not been overscrupulous in their efforts to comply with the Price of Coal (Limitation) Act, and to its lament over the collieries in South Wales that are losing money, has caused a correspondent to send us information as to the financial results of the working of some thirty South Wales colliery companies for some years past. We said on May 1 that the dividends some of the South Wales collieries had been paying during the war would make the mouths water of the stockholders in sliding-scale gas companies. An examination of the figures sent to us causes us to reflect as to whether further allusion to the matter will not make gas shareholders still more dissatisfied. However, we will risk saying that not a single colliery company out of the thirty went without a dividend last year. And what dividends some of them were! From 10 to 20 p.ct. are common among them—in some cases preference and ordinary shared richly in the golden harvest. More than one of the concerns paid 25 p.ct., another 30 p.ct., one 50 p.ct., but nothing before, and another contented itself with 55 p.ct., including 40 p.ct. bonus in preference shares. Profits naturally varied considerably; and not all the companies have during the war period enjoyed the heavy distributions named. But there is no question the thirty companies have done well. Some of them were doing magnificently before the war. And since, besides paying excellent dividends, the opportunity has been taken of reinforcing an already good financial stability. As the accounts are examined, we are wondering what really induced Mr. Runciman to allow the South Wales owners the extra 2s. 6d. per ton on the standard price of 4s. as provided by the Price of Coal (Limitation) Act.

Works Organization and Efficiency.

In the course of a paper which he contributed at a recent meeting of the Society of Arts, Prof. W. Ripper, Vice-Chancellor of the University of Sheffield, dealt at length with the subject of works organization and efficiency. The many aspects of a difficult problem were considered; and, among other things, emphasis was laid on the need of an improved education for the worker, in order to broaden his mind, so that his daily work may

not be his only interest, and his daily life may become something more than a merely sordid drudgery for wages. But, said the author, "above all there is a great demand for skilled and competent leadership, and for organizing and administrative ability; and business and commerce will be keen rivals with the professions for the best talent that the country can produce. The demand of every branch of industry for men of scientific training and experience will be greater in the immediate future than ever before." The industrial future, it was urged, must be something more than a mere fevered scramble for profit on the part of the employers, or for wages on the part of the men. "Trade and industry must be recognized as the natural healthful and normal means whereby the nation is able to express itself in useful service, and to realize itself in ever-improving quality of work, as distinguished from the increase of mere quantity. To accomplish this result will require from each of us, from the highest to the lowest, some helpful effort of our own and some devoted and loyal service in promoting the well-being of the industry to which it is our privilege to belong." Opening the discussion on the paper, the Chairman (Mr. Dugald Clerk, D.Sc.), while sympathizing with the author's wish to improve the lot of the workingman, pointed out that the workman could not obtain the sufficient wage he wanted out of the present output. He thought it would be found that the employers at the present time were really desirous, in very many cases, of finding a way out of the difficulty, so that they and the employed might live together in harmony, and work together for the common end of supporting the whole of the country in a state of prosperity. He was followed by Sir Robert A. Hadfield, F.R.S., D.Sc. (the President of the Society of British Gas Industries), who said it was no good minimizing the fact that at the present moment there is unfortunately a spirit of great unrest in this country. In this connection he drew attention to the fact that a new Association, called the National Alliance of Employers and Employed, has been formed, as a result of the work of the new Federation of British Industries. This body he hopes will before long give a good account of itself, and discuss questions, not when a strike is about to take place, but long before that stage is reached.

Fuel Exports and Values.

The fuel exports continue to shrink; the values to expand. In March 3,025,442 tons of coal, coke, and manufactured fuel were exported, compared with 3,281,793 tons in March, 1916, and 4,143,756 tons in March, 1915—the values for the several periods being: 1917 £4,084,583, 1916 £3,565,210, 1915 £3,179,635. The average value per ton was £1 6s. 4d., as against £1 1s. 9d. in March, 1916. Aggregating the exports for the first quarter of the year, the amount of coal, coke, and manufactured fuel was 9,416,553 tons, compared with 9,975,276 tons in 1916, and 11,698,248 tons in 1915. The values for the quarter were: 1917, £12,455,346; 1916, £10,155,609; and 1915, £8,446,742.

Société Technique du Gaz.

A release from the engrossing business of war must come before our French confrères of the Société Technique can resume the annual summer congresses at which in the past so many valuable technical papers have been read and duly translated into our pages. But it is good to note that for, we believe, the first time during the war, French gas technicians will hold an assembly in which something more than routine business will have a place. This reunion will be held in Paris on June 8, under the presidency of M. F. Rouland. The programme is of the briefest, but the morning session will be set apart for the discussion of general problems arising from the national circumstances. In the afternoon, there will be some papers on the carbonization of coal.

Forthcoming Manchester District Institution Meeting.—The Hon. Secretary (Mr. G. S. Frith) intimates that the 178th quarterly meeting of the Manchester District Institution of Gas Engineers will be held at the Grand Hotel, Aytoun Street, Manchester, at 2 o'clock on Friday, the 25th inst. (and not Saturday as hitherto). Owing to the important subjects to be considered, it has been decided to hold this meeting in private; and consequent upon the curtailment of travelling facilities, the usual tea will not be provided at the close of the proceedings. The following are the matters to be discussed: "Labour Difficulties Due to the Demand for all Eligible Men for the Army and National Service," to be introduced by Mr. S. Meunier, of Stockport. "Coal Supplies," to be introduced by Mr. Samuel Glover, M.Inst.C.E., of St. Helens. Certain recommendations from the Committee to be forwarded to the National Gas Council, on the subject of tar and its products.

INSTITUTION PRESIDENCY.

Lord Moulton's Acceptance.

We are gratified at being able to publish the following correspondence, from which it will be seen that the Rt. Hon. Lord Moulton, K.C.B., F.R.S., of the High Explosives Department of the Ministry of Munitions, has been elected an honorary member of the Institution of Gas Engineers, and has intimated his willingness to accept the presidency of the Institution for the coming year.

The Institution of Gas Engineers,
39, Victoria Street, S.W. 1,
May 9, 1917.

The Rt. Hon. Lord Moulton, K.C.B., F.R.S.,
Ministry of Munitions, High Explosives Department,
Storey's Gate, S.W. 1.

My Lord,—I have the honour of informing you that at a meeting of the Council held yesterday the nomination of President for the year 1917-18 was considered. It was unanimously resolved that you be asked to allow the Council to nominate you for election, first as an honorary member of the Institution, and secondly as President for that period.

I am to say that the Council feel very strongly that your nomination to this position would be received throughout the gas engineering profession and industry with the warmest approbation, when it is remembered that you have taken the leading part in the organization and administration of a department the results of the work of which were evident soon after its formation, and which have increased in importance since that time. The recent victories of the British and their Allies must be traced to the abundant supplies of high explosives, which are due to your initiative and close attention. In this work, of course, the Institution has fortunately been able to have the honour of assisting you; so that the Council feel that there is a close association between yourself and the Institution.

I need scarcely add how highly we should appreciate your acceptance of the honour which we are anxious to do you, and venture the hope that your favourable reply may be returned for communicating to the Council.

(Signed) Walter T. Dunn, Secretary.

Westminster, S.W. 1,
May 10, 1917.

Dear Mr. Dunn,—I am greatly flattered by the exceptional honour which the Council of the Institution of Gas Engineers wish to do me in nominating me for election as an honorary member of the Institution in the first place, and as their President for the coming year.

It is quite true that during the past year there has been a very close associateship between myself, as Director-General of Explosives Supply, and the Institution of Gas Engineers; and I can safely say that the assistance rendered me in the arduous task which was before me has been of the highest service to the State and of incalculable value to the success of our arms.

To act as President of such an organization over the coming year under these circumstances will be a great pleasure to me, and a great honour.

(Signed) Moulton.

PERSONAL.

Mr. E. W. Smith, Chief Chemist to the Birmingham Corporation Gas Department, has been recently elected a Fellow of the Institute of Chemistry.

Mr. James Canty has been appointed Secretary and Manager of the Balbriggan (co. Dublin) Gas-Works, in succession to the late Mr. Joseph M'Gowan.

Second-Lieutenant Hilton Furniss, West Riding Regiment, who is reported wounded and in hospital at Cambridge, is the third son of Councillor John Furniss, the Secretary and Manager of the Slaithwaite Gas Company. He assisted his father at the gas-works when in civil life.

After spending 21 years abroad in the service of the South African Lighting Association, Ltd., Mr. W. Arnott, the Manager at Port Elizabeth, has given up the position, and has been granted a retiring allowance. He is succeeded by Mr. John Donaldson, who has been his Assistant for two years.

The London Coke Sales Committee have consented, upon the request of the Coal Controller, to their Fuel Expert, Mr. E. W. L. Nicol, assisting and advising him in the matter of coke supplies and use, with the view to realizing the greatest possible advantage through it in furthering the cause of coal economy.

Considerable anxiety was occasioned to the family and friends by the receipt of official information at Nottingham, last Friday, recording that Captain Albert Ball, D.S.O., M.C., son of Alderman A. Ball (the Chairman of the Gas Committee), had been missing in France since the previous Monday. Captain Ball has been responsible for many brilliant aerial exploits.

On the 25th ult., at St. Laurence Church, Middleton St. George (co. Durham), the marriage was solemnized of Mr. R. Albert Grainger to Miss Cicely R. Bower, daughter of (the late) Mr. Thomas Bower, of West Hartlepool and Middleton St. George. Miss Bower was formerly a constant attendant, with her father and mother, at the social functions associated with the annual

meetings of the Institution of Gas Engineers; and we know we can join with our own the hearty congratulations of a large circle of readers.

Mr. J. A. Macdonald, J.P. (the Chairman of the Ilkeston Corporation Gas Committee) and Mrs. Macdonald have been the recipients of handsome presents from the townspeople and friends resident in the district, in recognition of their year's service as Mayor and Mayoress of the borough. Mr. Macdonald acted as Chairman of the Gas Committee during the critical period of the reconstruction of the works necessitated by the accidental demolition of one of the principal holders; and he has contributed largely to the success of the concern.

At a meeting of the Manchester Corporation Gas Committee on Friday, the Superintendent (Mr. Fredk. A. Price) reported that Mr. John Grimes, Senior Collector of Gas-Rentals, completed fifty years in the Corporation service on the 7th inst. Mr. Grimes began work in the Township and Highways Rates Office; and when the office was abolished in 1872, he was transferred to the Treasurer's Office to collect disputed accounts. He was appointed a Gas-Rent Collector in 1875, and is now the senior member of this branch of the staff, and still satisfactorily performing his duties. The Chairman (Alderman W. Kay, J.P.) was requested by the Committee to heartily congratulate Mr. Grimes on his long and faithful service.

Mr. A. T. Harris, of Market Harborough (an old Volunteer with thirty years' service), has received official notification that his eldest son, Second-Lieutenant W. Harris, of the Leicestershire Regiment, was missing and believed to be wounded on May 3. Second-Lieutenant Harris, who was 21 years of age on March 31 last, was educated at Wellingborough School. He served a year at the Malvern Gas-Works, then under Mr. W. J. Rendell-Baker, and had only been appointed on the staff at the Market Harborough Gas-Works a few weeks when war was declared. In September, 1914, he joined as a private the "C" Company of the 7th Northants, with whom he went to France in August, 1915, and took part in much fighting, including the battle of Loos. He returned to England in the summer of 1916, and was granted a Commission and posted to the 8th Battalion of his Home County Regiment; returning to France during the first week of the present year. Mr. Harris's youngest and only remaining son is a member of the Nottingham University O.T.C., and is shortly proceeding to South Farnborough with the view to qualifying as a pilot in the Royal Flying Corps.

OBITUARY.

The death has taken place of Mr. Albert Bennee, the Chairman and Managing Director of the late Devonport Gas Company.

It is with sympathetic feelings that we announce, and many readers will learn of, the death of Mr. Bernard Frederick Smith, only son of Mr. F. R. Smith, of Messrs. Parkinson and W. & B. Cowan, Ltd. Educated at Mill Hill School and completing his engineering training at the works of the St. Albans and Southgate Gas Companies, Mr. Smith passed the examination and took the diploma as an associate member of the Institution of Civil Engineers. Subsequently he was assistant to his father in the engineering department of Messrs. Parkinson and Cowan, where his previous training in gas manufacture and utilization was of considerable value. Soon after war broke out, Mr. Smith volunteered for military service, joining first as a private in the Honourable Artillery Company; afterwards obtaining a commission in the 12th Essex Regiment. After a year's service, he was invalided out of the Army owing to an operation which undermined his health. After a severe illness lasting some three months, he passed away on the 7th inst. The gas industry has lost another of its promising sons; his old friends a charming companion; his parents a son of whom they are justly proud.

Bye-Products in Coking Practice.—At the annual meeting in Leeds of the Yorkshire Section of the Society of Chemical Industry (Prof. J. W. Cobb presiding), a paper was read by Mr. G. E. Foxwell, of Sheffield, on "Some Future Lines of Advance in Coking Practice," in which it was pointed out that great improvements were capable of being made in connection with the recovery of bye-products. The author said, for instance, a method was wanted which would enable the ammonia to be recovered as sulphate, using the sulphur contained in the coal to provide the necessary sulphuric acid. Naphthalene was another compound which had been neglected. The market for this product was growing. The present system of making 65 p.ct. benzol was not the one calculated to give the best results. It was found in practice that by manufacturing benzol of 55 p.ct. strength there was a very considerable increase in the amount of toluene recovered. It seemed, therefore, preferable to recover benzol of much lower strength than at present, and to wash it for phenol. It would be very advantageous also if a system could be found whereby the carbon disulphide could be recovered from the gas before taking out the benzol. In all probability the coke-oven plant of the future would manufacture pure benzene, toluene, and xylene, as well as nitro-benzene, nitro-toluene, aniline, toluidine, and possibly pure naphthalene. The manufacture of the raw material for dyes would be more rationally carried out on coking plants than at the dye-works.

A GAS INDUSTRY BUILDING COMMITTEE.

The following circular-letter has been issued by Mr. Walter T. Dunn (the Secretary of the Institution of Gas Engineers) on the subject of the formation of a Committee to discuss the subject of providing a building as a central home for the gas industry.

THE INSTITUTION OF GAS ENGINEERS.

Building Committee.

Dear Sir,—As you are probably aware, in the interests of the members and of the gas engineering profession and gas industry generally, the Council of the Institution of Gas Engineers have for several years past had under consideration the desirability of providing a building as a central home for the gas industry in which the Council may meet, where a good library of books dealing with the manufacture, distribution, and sale of gas may be available for reference and loan, and where the meetings of the National Gas Council, of the Institution, of the British Commercial Gas Association, of the Society of British Gas Industries, of the Gas Companies' Protection Association, of the District Associations, and of the Commercial Sections of the District Associations, and the respective Committees of all these bodies, may be held. The building would also be available for arbitration purposes, parliamentary conferences, and meetings of shareholders. Members of gas committees of corporations, and members of boards of directors of gas companies could use the building for business appointments, and in connection with Parliamentary Bills, as it should be situated near the Houses of Parliament.

There can be no doubt that, when the Institution enters into possession of a building of its own, it will enable the work of the gas industry to be more vigorously advanced than has been possible hitherto.

A chemical laboratory could be provided in the building where the testing of coal, coke, sulphate of ammonia, &c., the evaluation of the composition of gases, and investigations into the efficiency of various kinds of gas burners, appliances, and industrial gas apparatus could be carried out under the auspices of the Institution, through competent committees. The building would also be available for the holding of classes in gas manufacture, in gas engineering, distribution, and gas-fitting; and public lectures could be given there as required.

The Council have already received promises of support from a number of prominent members of the Institution, and are anxious to proceed with the preliminary steps for giving effect to the desire expressed by the members generally that such a building should be provided. The Institution's building fund stood at the amount of £632 4s. 6d. at the end of last year.

It would, of course, not be possible to commence building operations until after the war; but the acquisition of a suitable site, and designs for the building, could be considered, and also steps for raising the necessary fund.

At a well-attended meeting of the Council held recently, it was unanimously resolved that a Committee consisting of the gentlemen whose names are given on the enclosed list should be appointed to discuss the matter and report to the Council as to the course to be followed, with a view to making recommendations to the members at the annual meeting, which is to be held at the Institution of Civil Engineers, on Tuesday, June 5.

Walter T. Dunn, Secretary.

39, *Victoria Street, S.W.* 1,
May 11, 1917.

BUILDING COMMITTEE.

President of the Institution:

Mr. A. E. Broadberry, of Tottenham.

President Elect:

The Rt. Hon. Lord Moulton, K.C.B., F.R.S.

Vice-Presidents:

Mr. Samuel Glover, of St. Helens.
Mr. Thomas Berridge, of Leamington.

Hon. Secretary:

Mr. W. E. Price, of Hampton Wick.

Hon. Councillors (Immediate Past Presidents):

Mr. John Young, of Hull.
Mr. John Bond, of Southport.
Mr. Robert G. Shadbolt, of Grantham.

Ordinary Members of Council:

Mr. J. W. Auchterlonie, of Cambridge.
Mr. John C. Belton, of Chester.
Mr. Sydney Y. Shoubridge, of Lower Sydenham.
Mr. William W. Woodward, of Salford.
Mr. Thomas Goulden, of London.
Mr. Thomas Hardie, of Newcastle-on-Tyne.
Mr. Edward A. Harman, of Huddersfield.
Mr. Hubert Pooley, of Leicester.
Mr. John Foster, of Birmingham.
Mr. F. W. Goodenough, of London.
Mr. Henry Kendrick, of Stretford.
Mr. G. Stevenson, of Long Eaton.

District Members of Council:

Mr. W. B. Farquhar, Eastern Counties Association.
Mr. A. S. Brook, Irish Association.
Mr. W. Whatmough, Manchester District Institution.
Mr. C. H. Webb, Midland Association.
Mr. Alex. Masterton, North British Association.
Mr. William Hardie, North of England Association.
Mr. W. Doig Gibb, Southern District Association.
Mr. H. D. Madden, Wales and Monmouthshire District Institution.

Presidents of the Eight District Associations Affiliated with the Institution:

Mr. JOHN TERRACE, of Great Grimsby (Eastern Counties Association).
Mr. H. KIRKHAM, of New Ross (Irish Association).
Mr. WALTER WHATMOUGH, of Heywood (Manchester Institution).
Mr. C. H. WEBB, of Stourbridge (Midland Association).
Mr. JOHN LANG, of Alexandria (North British Association).
Mr. R. NELSON, of East Hull (North of England Association).
Mr. W. N. WESTLAKE, of Exeter (Southern District Association).
Mr. A. W. BRANSOM, of West Hartlepool (Wales and Monmouthshire District Institution).

Mr. J. D. ASHWORTH, of Portsmouth.
Alderman A. BALL, J.P., of Nottingham.
Mr. J. FERGUSON BELL, of Derby.
Sir JOSEPH BELLAMY, J.P., of Plymouth.
Mr. CHARLES CARPENTER, of London.
Mr. GEORGE CLARRY, of Cardiff.
Mr. DUGALD CLERK, F.R.S., of London.
Alderman JAMES CRAIG, J.P., of Belfast.
Mr. WADE DEACON, J.P., of Liverpool.
Professor H. B. DIXON, F.R.S., of Manchester.
Mr. ANDREW DOUGALL, of Tunbridge Wells.
Sir FORTESCUE FLANNERY, Bart., M.P., of London.
Mr. G. S. FRITH, of Runcorn.
Mr. R. S. GARDINER, of London.
Mr. THOMAS GLOVER, of Norwich.
Rt. Hon. Sir D. FORD GODDARD, M.P., of London.
Alderman PENROSE GREEN, J.P., of Leeds.
Mr. CHARLES HAWKSLEY, of London.
Mr. JAMES W. HELPS, of Croydon.
Mr. W. R. HERRING, of London.
Mr. CHARLES HUNT, of London.
Mr. DANIEL IRVING, of Bristol.
Bailie T. J. IRWIN, of Glasgow.
Mr. A. A. JOHNSTON, of Brentford.
Mr. H. E. JONES, of London.
Alderman WILLIAM KAY, J.P., of Manchester.
Lord Provost J. LORNE MACLEOD, of Edinburgh.
Mr. JOHN MURPHY, of Dublin.
Mr. R. J. NEVILLE, M.P., of London.
Mr. WILLIAM NEWBIGGING, of Manchester.
Mr. A. F. PHILLIPS, of London.
Alderman F. S. PHILLIPS, J.P., of Salford.
Sir HALLEWELL ROGERS, J.P., of Birmingham.
Mr. J. D. SMITH, of Belfast.
Lieut.-Col. A. SMITHELLS, F.R.S., of Leeds.
Sir W. H. STEPHENSON, J.P., of Newcastle-on-Tyne.
Mr. D. MILNE WATSON, of London.
Mr. ALEXANDER WILSON, of Glasgow.
Mr. CHARLES WOOD, of Bradford.
Mr. HENRY WOODALL, of London.

WALTER T. DUNN, Secretary.

A meeting of those who consent to serve on the Committee will be held at the offices of the Institution on Monday next.

The "Electrician" Electrical Trades Directory.

Once more a copy has reached us of what is familiarly known as the "Big Blue Book." This, by the way, is in all respects a perfectly accurate description of the volume, though on the present occasion, for reasons connected with the war which have long since become clear to the book and newspaper reading public, it is less bulky than usual. However, the features which have made previous issues of the book popular appear again in the 35th annual edition of the book—the formal title of which is the "Electrician" Electrical Trades' Directory and Handbook. There is a full digest of the law as bearing on matters electrical; and the law relating to patents, trade marks, and designs is similarly dealt with. Then there are the various rules and regulations existing in this country for the installation of electric light, power, and traction; the Home Office regulations for the generation, transformation, distribution, and use of electrical energy in factories and workshops; and the regulations affecting the application of electricity to mines and collieries in this and other countries. The financial section is a very complete one; and there are many tables, &c., setting forth information useful to those concerned with electricity. The biographical division once more finds a place in the book; and there is also a complete biography for the past year. As to the directory itself, this contains the name and address of practically every person engaged in the electrical profession and industry throughout the United Kingdom, with telephone numbers and telegraphic addresses; while the classified trades section gives full particulars of the various firms and companies engaged in the different branches of the industry. Sections are also devoted to the British Colonies, the Continent of Europe, Asia, and Africa, Central and South America, and the United States. The published price of the book is 15s. net, postage extra; and in forwarding a copy for review, the "Electrician" Printing and Publishing Company, Ltd., of Salisbury Court, E.C., point out that every line has undergone careful and thorough revision up to the moment of publication.

Annual Meeting of the Society of Chemical Industry.—The date of the annual general meeting of the Society of Chemical Industry has been provisionally fixed for July 18-20, at the Birmingham University. Among the list of papers to be read, the following will be of particular interest to "JOURNAL" readers: "Refractory Materials," by Mr. Walter C. Hancock. "Low-Temperature Distillation Fuel," by Prof. O'Shea. "Industrial Fuel from Gas-Works," by Mr. E. W. Smith. "Calorific Value of Industrial Gaseous Fuel, by Mr. W. J. Pickering. "High-Pressure Gas for Industrial Purposes," by Mr. C. M. Walter. "Some Sources of Benzol and Toluol for High Explosives," by Mr. T. F. E. Rhead. "Organization of Industrial Research," by Mr. H. W. Rowell. "Scheme for Co-Operative Industrial Research," by Mr. H. W. Rowell.

INSTITUTION OF GAS ENGINEERS.

Meeting of the Council.

A Meeting of the Council of the Institution was held last Tuesday at the Central School of Science and Technology, Stoke-on-Trent, by permission of the Governors—the PRESIDENT (Mr. A. E. Broadberry) in the chair. There was a very full attendance.

AN APPEAL FROM THE COAL CONTROLLER—DILUTION BY WATER GAS.

Included in the first items of the *agenda* was the consideration of a letter which the President had received from the Controller of Coal Mines of the Board of Trade, which was as follows:

Dear Sir,—Your attention is requested to the importance of bringing under the notice of the gas industry the urgent necessity of restricting, as far as possible, the quantity of coal used for gas making.

May I suggest, as a means of doing this, the substitution of water gas for coal gas to the greatest practical extent consistent with the requirements of the Ministry of Munitions (who should be consulted in all cases), and the adaptability of the mixed coal gas and water gas for the industries using gas for special fuel and for lighting purposes.

I am advised that, owing to the limited supply of gas oil, a number of works provided with water-gas plants may have discontinued their use; but if certain precautions are taken, 10 to 25 p.ct. of uncarburetted gas and a higher percentage of slightly carburetted gas can be added to the coal gas. The saving in coal, and transport of the same, to be effected by this practice, if consistently carried out, will be substantial, and the relief to the railways in proportion. The urgent necessity for relieving the railways is of the utmost importance; and I therefore have to request that you will take an early opportunity of laying the matter before the members of your Council, with a view to the whole subject being ventilated and the necessary steps taken as far as circumstances will allow.—Yours faithfully,

(Signed) GUY CALTHROP.

The President, Institution of Gas Engineers.

It was decided to bring the letter under the notice of the gas undertakings of the country, with an expression of the hope that the request contained in it will receive the earnest attention of all the engineers, so that the object set forth in the letter may be achieved without delay.

MEMBERSHIP.

The question as to the reinstatement in their former positions of members who had joined the forces was considered and referred to the Emergency Committee, with a view to the introduction of some system whereby the interests of those who had acted so patriotically would be safeguarded when demobilization comes about.

The following were approved as candidates for election. Members: Mr. F. C. Briggs (Dudley), Mr. F. G. Brookman (Tenby), Mr. William Blair (Santos, Brazil), Mr. W. T. Lancaster (Devizes), Mr. F. A. Last (Halstead), Mr. A. F. Thomas (Aberkenfig), Mr. Godfrey Warburton (Tottenham). Associate members: Mr. Ermin A. Leask (Leeds), Mr. John J. Hurley (Christchurch, N.Z.), Mr. L. A. Rumble (Reading). The following were transferred from the class of associate member to that of member: Mr. Robt. B. Braddock (Radcliffe), Mr. A. Douglas Cooke (Smethwick), Mr. Harold E. Stone (Birkenhead), Mr. E. B. Tomlinson (Birmingham).

The death of Mr. W. D. Child (late of Romford) was announced; and a vote of sympathy with his relatives was passed.

DISTRICT MEMBERS OF COUNCIL.

It was reported that Mr. J. Terrace had been appointed District Member of the Council to represent the Eastern Counties Association; Mr. H. Kirkham, the Irish Association; Mr. G. S. Frith, the Manchester District Institution; Mr. C. H. Webb, the Midland Association; Mr. J. Lang, the North British Association; Mr. W. Hardie, the North of England Association; Mr. W. N. Westlake, the Southern District Association; and Mr. A. W. Branson, the Wales and Monmouthshire District Institution.

The nomination of President, Vice-Presidents, Officers, and Council for the year 1917-18 was proceeded with.

THE JUNE MEETING.

The programme of the annual meeting for Tuesday, June 5, was decided upon; and it was arranged that there should be a session in the morning and in the afternoon.

An invitation from the Directors of the Tottenham Light, Heat, and Power Company to visit their works on the following day was accepted, with expressions of thanks.

EXAMINATIONS FOR GAS-FITTERS.

A communication was reported from the City and Guilds of London Institute, stating that in the new syllabus with reference to examinations for gas-fitters the following would be inserted:

With his application for entry to the examination, each candidate will be required to furnish a certificate signed by his employer, stating that the candidate has been engaged for not less than twelve months in the practice of gas-fitting, and that he is considered to be a fair workman.

REFRACTORY MATERIALS—CONTRACTS—SALE OF GAS ACT.

The report of the representatives of the Institution at the Conference on Refractory Materials Research was presented, accepted,

and adopted. It is expected that another meeting of the conference will take place this month, at which representatives of all societies interested in refractory materials will be present, when a scheme will be proposed with a view to co-ordinating work which is in course of progress at the present time.

The Standard Conditions of Contract, as agreed between the Institution and the Society of British Gas Industries, were ratified.

The Parliamentary Committee presented their report with reference to certain proposals which had been brought under their notice advocating the expediency of an amendment to the Sale of Gas Act, 1859. It had been referred by them to the Life of Gas-Meters Committee, who were giving it attention.

Standard Street Lighting Specification.

A communication was considered from the Institution of Electrical Engineers as to the question of publishing the majority report of the Joint Committee on the Standard Street Lighting specification. No objection was raised to the publication of the report, on the understanding that the following statement from the minority of the Committee should be appended to it:

The Council of the Institution of Gas Engineers at an early date expressed their opinion that the appraisement of street lighting in terms of the minimum horizontal illumination obtained is not a correct method of measuring the illumination given by street-lamps, inasmuch as it is affected by the light given from other sources, of varying intensity in different places and at different times. At a meeting of the Joint Committee held on Jan. 24, 1916, it was agreed to appoint a Sub-Committee to consider and report on a proposal to amend the specification so as to ensure a statement of both maximum and minimum horizontal illumination with defined ratios. Such an amendment would have considerably modified and lessened the objection to the specification as previously drafted. It is regrettable that the Sub-Committee were unable to find a suitable form of words to bring forward, and that no such amendment is therefore to be included. The Council of the Institution of Gas Engineers formally express their opinion that contracts for street lighting should be based on the average candle power of light sources ascertained at two or three defined angles. This, in the opinion of the Council of the Institution of Gas Engineers, is the simplest and most correct method, and, moreover, would avoid the possibility of disputes arising from the more or less uncertain measurement of minimum horizontal foot-candle values.

A cordial vote of thanks was passed to Mr. Robert Watson, the Institution representative on the Joint Committee, for the great interest he had taken in the work from the time of its inception.

Other Matters.

The report was presented of the representatives of the Institution who had given evidence before the Home Office Committee to inquire into the social and economic results of the Summer Time Act, 1916, and to consider whether it is advisable that Summer Time should be re-introduced in 1917 and in subsequent years. This Act came into operation on Sunday, April 8; and the time of the sun will be reverted to on Sunday, Sept. 23.

The report of the Special Committee on Naphthalene Stoppages was presented, in which it was stated that the *brochure* dealing with the matter had been issued by them to the engineers of all gas undertakings throughout the United Kingdom. A vote of thanks was passed to Dr. H. G. Colman and Mr. W. E. Price for their assistance.

An application from the Gas Lighting, Heating, and Ventilating Committee was considered for a grant to enable them to undertake some very important work which required immediate attention in the interests of the gas industry. After careful discussion, it was resolved that the sum of £450 should be voted from the special purposes fund of the Institution for this object.

It was announced that the Institution had been added to the list of Associations belonging to the Board of Scientific Societies in connection with the Royal Society. A report of a Sub-Committee appointed by the Board to consider and report upon national instruction in technical optics was communicated, and ordered to be filed.

The reports of the Parliamentary Committee, the Finance Committee, and the Emergency Committee were presented, accepted, and adopted.

A letter was read from the Institution of Heating and Ventilating Engineers requesting the Council to consider a proposal for drawing up a series of symbols and abbreviations especially useful in the science and practice of heating and ventilating. It was decided to refer the matter to the Emergency Committee for discussion and report.

Forms of Proposal for Institution Membership.

The Secretary of the Institution of Gas Engineers asks us to announce that forms of proposal for membership for the election taking place at the meeting on June 5 should be received at the offices of the Institution, No. 39, Victoria Street, Westminster, not later than May 21. Candidates who are approved for the ballot will receive invitations to attend the meeting as visitors.

ELECTRICITY SUPPLY MEMORANDA.

The electrical journals are very dissatisfied with the position of the electricity supply industry in the matter of the work that has been, or is being, done for its commercial development. It is all very right and proper, it is argued, to undertake work to produce more economy at the generating end; but this ought to have its supplement in work at the sales end. Trying to hustle in this way is of no use. Better by far get the work thoroughly in hand for improving and consolidating the fundamental part of the industry's operations than to simultaneously enter upon other work, with the result that, attempting too much at once, may give defective results in both directions. If by concentrated effort the issue of the work at the generating end is a material economy, this means cheaper electrical energy at the consumers' end; and this alone should achieve much in commercial development. From the flapping of wings and the crowing that there have been of late in certain electrical papers as to the position that electricity has established for itself during the war, combined with the much-proclaimed intrinsic merits of electricity for numerous purposes, there hardly seems any necessity for immediate effort at the trading end. Nothing should, in such circumstances, be able to impede the flow of progress there. But the argument in this regard of, for instance, the "Electrical Review," is scarcely logical—at any rate, so far as industrial sales development is concerned. "The war," it says, "has riveted the attention of industry on the utility of modern electrical methods." What more, if as much, could publicity efforts by the electrical industry do? The attention of industry being "riveted" on the utility of electrical methods, there is no chance of industry escaping the adoption of this utility, and therefore no chance for a look-in on the part of any other industry. But the other industries smile at the high-seasoned electrical expressions. One of which we wot has been under some sense of pride that extra millions upon millions of cubic feet of its commodity have daily been wanted by industry during the war, and that other industries have come to look upon it as an essential industry in producing the materials required for their existence. But the industry has never been so vain as to think that the war has "riveted" attention upon its utility.

The Supplement to Generating Economy.

Cultivation and Demand.

However, according to the "Review," electrical publicity and educational efforts hitherto have been isolated and uncoordinated, and altogether unworthy of the great industry. "Its real business organization is a myth, and its salesmanship an anachronism." We suggest that the critic should be director-in-chief of an organization charged with the performance of the work which has been so ill-done in the past, and which should be so much better done in the future. Why not? He evidently knows all about it. One of the things he strongly advocates is that there should be a closer understanding between the electricity industry and the Press generally; and he is not satisfied that any body that has yet been formed is really suitable for the work that crowds his mind as being requisite for the development of an industry the utility of whose modern methods is so great that the attention of industry has been riveted upon it. There is the Development Committee to which the Incorporated Municipal Electrical Association gave birth. This Committee is in a state of suspended animation. A reconstituted Development Committee, it is thought, is required, representing the whole of the electric supply and allied interests, and embodying in addition to, or conjointly with, its Publicity Sub-Committee a Special Press Sub-Committee, for the purpose of facilitating friendly relations with the Daily Press, so as to influence public opinion by its means. The critic and adviser has evidently gone in for allotment work; for the reason for his recommendation is discovered, allegorically expressed, in an earlier sentence: "One does not expect to raise much of a crop merely by flinging seed on to uncultivated ground." "Electrical Industries" also seems horticulturally touched just now. It does not like the present gap in electricity publicity work—even such as it has been in the past. The work that electricity stations have done in this way has been stopped because of the inability in some quarters to connect up new consumers. It is thought by such undertakings that it is absurd to now spend money or time in advertising the benefits of electricity in any direction; but remarks our contemporary: "This line of argument implies a testimonial to publicity more flattering than most central stations are in the habit of giving in public. It declares that publicity does have an immediate effect in stimulating demand, and is not merely a ploughing of more or less barren soil for a distant and speculative harvest." "Electrical Industries" is always a professed admirer of what the British Commercial Gas Association does; but in those professions we read an adroit manœuvre to stir up the electricity industry to equal if not better the work of the "B.C.G.A." At the moment, it has its eyes on what has been done of late in drawing public attention to the value of gas in relation to national economy, the production of munitions, and the application of gas to industrial purposes. These are all very real things. The electricity supply industry knows it; and, knowing it, it is dissatisfied that it cannot make larger claims itself. Hence the criticism, and the advice to

work at both ends of the line (the generating and the sales ends) at the same time.

Electric Light Not Essential in War Times.

In the same number of "Electrical Industries," attention was called to a report in "The Times" of an incident at the Burgess Hill Tribunal when the case of an electrical engineer classed "B 1" was under discussion. "A most useful man," said the military representative; "we want to put up telephones as we advance." "But what is to be done with the electric light works?" asked the clerk. "What about the houses where only electric light is in?" added the Chairman. The military representative was equal to the interrogators: "We must use lamps. We are at war; and we want the men." The electrical man concerned was made available for work at the front. On this, "Electrical Industries" argues: "Assuming the electric light works were closed-down and the consumers used lamps, they would increase the demand for metal, which is very scarce and directly essential for military purposes." Perhaps the military representative was aware that private consumers of electricity are in the habit, having experienced the unfriendly disposition of electricity to suddenly fail them at inopportune times, to keep by them lamps or other means of lighting. Our contemporary advises that, to correct misapprehension, electric light companies should introduce into their titles "and Power." But our examination of the accounts of a number of electricity supply companies working in the Provinces assures us that "power" is an infinitesimal part of the business of some of them.

West Ham as an Objector and an Adviser.

The composition of the Committee appointed by the President of the Board of Trade to consider the ways and means by which a cheaper supply of electricity can be made available, is still a matter of some dissatisfaction in the industry. The West Ham Electricity Committee have informed the President of the Board that they are of opinion that, having regard to the important part at present "played" by local authorities in the supply of electrical energy, and the extensive character of their capital commitments in relation thereto, local authorities owning electricity undertakings are inadequately represented on the Board of Trade Committee. It is strange that, out of all the important municipal bodies owning electricity works, the West Ham authority should be the one to primarily move in this matter. They are already supported by Islington, Bradford, Bath, and Colchester. By next week their "bag" may be a heavy one. However, that may be, probably the West Ham Committee are at present conscious of the "important part" they have "played" in the management of their own undertaking. It will be remembered the Electrical Engineer recently estimated the serious deficiency of £35,000, and confessed that as 72 p.ct. of the output is under contract for a term of years, "this renders it impossible to raise prices to such an extent as would meet the increased cost of production." Perhaps the President of the Board of Trade will consider whether the West Ham Electricity Committee have "played" such a part in the management of their concern as to justify him in drawing from that body representatives of municipal interests to advise as to the correct lines to pursue in future. On second thoughts, however, it is likely that their present financial experiences may have shown them what to avoid in the future. At any rate, a cheap supply of electricity to manufacturers should always be accompanied by safeguards in the interests of other people. That it is not so accompanied is, at the present time, being experienced by drafts upon the ratepayers' pockets in several towns—not excluding certain Metropolitan boroughs.

Electric Incandescents v. Arcs in War Time.

The demand for a general economy, especially of coal, has induced various local authorities to consider the question of entirely discontinuing the use of electricity for street-lighting purposes during the summer months The Summer Time Act has favoured this. The same considerations do not apply to gas lighting, inasmuch as the Ministry of Munitions are not desirous of seeing the use of gas curtailed in any manner that will affect adversely their supply of materials for the production of explosives and propellants. However, in London a Joint Committee of the Borough Councils are unfavourable to the total abolition of lighting during the summer, but are willing to agree to make representations for a restricted and uniform system of lighting. The Westminster Electricity Supply Corporation, however, have pointed a way to economy, which has received the approval of the Works Committee of the Westminster City Council. It refers to that old and much-discussed district, St. George's, Hanover Square, the contract for the lighting of which with arc lamps at a heavy price was entered into many years ago. Perhaps to this is due the fact that it is possible to effect electrically a considerable saving there. It is acknowledged that the proposal is the outcome of representations by the Board of Trade as to the necessity of exercising the strictest economy in the use of fuel. It is stated that the substitution of incandescent lamps for arc lamps will effect a saving of at least 2000 tons of coal and 250,000 pairs of carbons per annum, together with the services of ten men. These are big considerations. The cost of the alteration is to be borne entirely by the Company, as also the cost of reinstatement of the arc lamps after the war. When all the 962 lamps involved have been altered, the rebate to the Council will be at the rate of £2650 per annum. It is stated that the "Dula" lamp (which is made in Holland) is to be used; but the Company are to undertake that none of the material or appliances is of enemy make or origin. The savings per lamp average over 2 tons of coal, 260 pairs of carbons, and the money saving, including labour, about £2 15s. When we consider the contract price per ton of good steam-raising coal delivered in London to-day, together with the price of carbons and the cost of labour, and think of what the £2 15s. per lamp includes, it can be understood why the Company find that it would be advantageous to bear the cost of effecting the change. The Islington Borough Council have also been considering the question of changing-over from arc to "half-watt" lamps in the streets; but they find it better not to do anything until after the war. Perhaps Westminster will give them new ground for consideration.

Where Do the Heat Units Go?

Another chatty little article on electric fires appeared a short time since in the "Electrical Review." We noticed one by "Experiment" on March 20. The later one is by "Hot Air;" and hot air is something we abhor for room heating, especially if it has been robbed of the major part of its humidity. That, however, has nothing to do with the article. "Hot Air" quotes the dictum of Prof. Osborn, from an article in the "Electrical World," that "for each kilowatt-hour of electrical energy put into any type of electric heater, the same amount of heat is furnished." Though quoting, and though interested, the writer in the "Review" is sceptical of Prof. Osborn. And so are we. Take the old lamp radiator for example, if the casing had a flat top, one could sit on it without causing any depreciation of the garment in contact, one could stand in front of it without getting scorched, and one could handle the casing without feeling the least discomfort. With 3420 B.Th.U. going into the radiator per hour, the question is why there was so little evidence of this fact in the amount of heat passing from the front, sides, or top of the radiator. "Hot Air" says the theory that "all the heat which goes into a radiator must come out of it, and that therefore the efficiency of every radiator must be 100 p.ct." may pass muster in the lecture room; but he submits that in practice the equality is not apparent. This winter our sceptical friend has sold 1000 electric fires from an unnamed showroom displaying fires by ten different makers. He can produce two fires, each with the same current consumption, giving results as dissimilar as a 16 c.p. carbon lamp taking 64 watts and a 60-watt metallic filament lamp. He can put a 3 KW. fire of one maker against the 2 KW. fire of another maker; and he guarantees the latter will be preferred for actual radiant heat, quite apart from the saving in current consumption. It does not therefore follow that what does go in to an electric fire in the way of electrical current must come out as heat in useful form. The question is where does the heat go to that is uselessly expended by the inefficient fire? When he comes to costs, "Hot Air" runs his head against a brick wall. He regards the future of electric heating as very hopeful; but he is inclined to jeer (without attempting disproof) at Prof. Osborn for opining that for dwelling-houses electric heating at 1 cent per kilowatt-hour costs three times as much as heating with coal at 30s. per ton. Does it not for an equal amount of heat? If this paragraph meets the eyes of "Hot Air," perhaps he will do us the favour of reading the first part of the notes in the "Memoranda" for Feb. 27, though as Prof. Osborn cannot please his critic, we suppose it would be impossible for us to convince him. The statement of the Professor as to cost he puts alongside one by a speaker at the last meeting of the American National Electric Light Association, who said: "The Almighty did not put enough calories into each kilowatt-hour to make electric water heating feasible."

Pyrophoric Alloys.

According to the "Engineering and Mining Journal" [New York], quoted by the "Chemical Trade Journal," common ferro-cerium contains only 15 p.ct. of iron, 2 p.ct. of bismuth or antimony, to harden the alloy, 5 p.ct. of copper, to make it more fusible, and silicon, a general impurity of the rare earth metals which has been taken up from the clay crucibles. The alloy of cerium with 25 p.ct. of platinum is considered the most highly pyrophoric. The alloy with mercury is expensive; zinc alloys are convenient for lighting miners' lamps; 25 p.ct. of magnesium or aluminium makes the alloy brittle and easy to pulverize. The presence of carbides is very undesirable, as the alloys, unless kept under oil, oxidize and lose their efficiency. The raw material for these alloys is the waste from the factories which extract thorium from monazite sand. The residue of various rare earths is converted into chlorides; and the anhydrous salts are electrolyzed in clay or water-jacketed iron crucibles provided with iron cathodes. The fluorides of the rare earths are not convenient for reduction. In America ferro-cerium has been much in demand for patent gas-lighters.

General Meeting of the National Gas Council.—The National Gas Council propose to hold a general meeting at Caxton Hall, at 4 p.m. on Monday, June 4—that is, the day before the Institution meeting. A report of the work of the Council since its inauguration will be submitted.

HYGIENIC TESTS AND STANDARDS OF GAS-HEATING APPLIANCES.

The paper from the "Journal des Usines à Gaz," a translation of which appears on another page, deals with the old question of the effect of gas fires and stoves upon the atmosphere of rooms; but, unlike many writings on the subject, it has a definite if narrow motive behind it—namely, the specification of testing methods for the purpose of determining the extent to which the air of a room is fouled by a stove through the addition of carbonic acid, and further for establishing evidence as to the non-liability of a stove to discharge positively harmful gases into a room in unfavourable conditions.

The latter objective relates to the formation of carbonic oxide in the products of combustion, and the possibility thus existing of the discharge of this gas into the room under the influence of severe down-draught. These are desirable aims, which cannot be too freely considered in relation to heating appliances of the hygienic excellence of the modern gas-fire. The results of such tests apply a useful corrective to the wild tales which now and again, in ignorant or prejudiced circles, still raise the bogey of a gas-stove as an engine of asphyxiation. But their purpose proper, and that which the French Central Coke Committee and the Paris Gas Company have had before them, is to adopt some working standard by which a gas-stove shall be judged from the hygienic standpoint before it, and fellows of its type, are sent out for the use of the public. As this is a matter in regard to which there is still much divergence of opinion, one or two points in the French communication may here be emphasized with advantage to our readers.

It will be noted that, in their adoption of standards, our French friends certainly make their choice on the side of safety. For carbonic acid, they take for the maximum proportion added to the atmosphere of the testing room during a four-hour action of a stove, the low figure of 0·1 p.ct. They speak of double this degree of vitiation (0·2 p.ct.) as just permissible, and refer in cautionary terms to increments of 0·8 or 1 p.ct. as harmful or dangerous. In this, they are immensely more severe in their requirements than many of the modern exponents, on the physiological side, of sanitation in heating. Dr. Leonard Hill, for example, in an address to the British Association in 1912, preached the doctrine of the innocuousness of air containing as much as 3 p.ct. of carbonic acid—instancing brewery employees who perform long shifts of physical work in such an atmosphere. Then Dr. Ott, in the paper on the testing of gas-fires which appeared in the "Journal" some fifteen months ago, expressed the view that 1 p.ct. of carbonic acid was not injurious to health. Most writers on public health, however, lay down the rule of about 0·1 p.ct. of carbonic acid as the criterion of a well-ventilated room. Hence the French figure, although identical, represents a great margin of purity, since it applies not to a freely ventilated room but to one (of no great size —about 10 ft. × 18 ft. × 13 ft.), the doors and windows of which have remained closed and the stove in full action for four hours before making the determination. Possibly this is too high a standard; but that it is one which is adopted as the normal performance of a gas-stove by the Paris Gas Company is sufficient tribute to the hygienic quality of heating by gas.

As regards carbonic oxide, there is again great discrepancy in opinions as to the proportion which may exist in air without it exerting a toxic effect. Dr. Ott in his paper declared—without, however, stating his evidence or authority—that 0·05 p.ct. was harmless in the air of a room. The French authorities, on the other hand, regard it as advisable that no carbonic oxide should be recognizable under the conditions of their test; and they fix 0·005 p.ct. as the absolute maximum. This is more in accordance with such public health data as 0·1 p ct. in air, which was found to give rise to a gradual depression of vitality, and 0·17 p.ct. the effect of which was fatal.

Such methods as those adopted by our French confrères are of course in a different category from the now widely adopted "Lancet" test. The latter is a valuable working means of saying "yea" or "nay" in respect to the hygienic quality of a gas-fire. The former are direct quantitative determinations of air-contamination; yet empirical in the sense that they cannot take any account, as does the "Lancet" test, of the particular conditions, chiefly of draught, under which the gas-fire does its work. None the less, it is well that such measurements should be regularly made and recorded. They will establish on a still firmer footing the hygienic properties of gas-fires. Figures and measurements tell their own tale; and it is just as well that they should be obtained by a method which can be applied under exactly comparable conditions to stoves consuming other fuel. The non-technical person cannot be expected to know that a mass of solid fuel in a state of slow combustion is a potential, and often an actual, source of contamination of air by carbonic oxide, and that such sources of heat are radically different as regards salubrity from those in which gas is subjected to complete combustion. In such work, the methods and standards adopted in France have the recommendation of previous usefulness to the same end.

Members of the Midland Section of the Coke-Oven Managers' Association will on Saturday of next week visit the Holbrook Coke-Oven and Bye-Product Plant at Killamarsh.

PROPERTIES OF REFRACTORY MATERIALS.

Among the papers read at the meeting of the Iron and Steel Institute meeting last Thursday week, was one on the properties of the refractory materials used in the iron and steel industry. Directly, the paper did not concern the gas industry; but indirectly some of the comments made have general application. Mr. Cosmo Johns, the author of the paper, is not only a geologist, but is metallurgist to Messrs. Vickers, at Sheffield; and he discussed the subject in its special relation to the iron and steel industry, after the manner of the discussion at the Faraday Society last year [see "Journal," Vol. CXXXVI., p. 341]. The main object of the paper was to treat of the properties required in refractory materials, and it pointed to the need for the stimulation of research.

Discussing the need for further research, Mr. Johns said that the manufacture of refractory materials was based almost entirely on empirical rules and the experience of the men employed. Such rules were the result of experiences gained during a century or more by a rude process of trial and error, but where there were very inadequate means of correlation. The methods employed to-day represented the survival of the fittest by the searching test of commercial success; but it by no means followed that they represented the best attainable. Further progress, if made at all, could only be slow and uncertain. The first step—and, in all probability, the one easiest to take—would be to prepare specifications for the most important refractory products expressed in terms capable of precise measurement or description, basing the specification on the best current practice. This would only be following the excellent example of the gas industry in the standard specifications published in 1912. These specifications should be the starting point of systematic research which should cover not only the problems that occur during manufacture, but the occurrence in nature and the characteristics of the raw material. Their concentration and purification, proximate and ultimate analysis, mineralogical description, and thermal analysis, were all points in which additions to present knowledge would be of great value.

The subsequent discussion was noteworthy for the manner in which British manufacturers were blamed for their unscientific methods and their lack of suitable testing plant; while, on the other hand, great play was made with the progress in Germany and America in the manufacture of refractories.

Sir Robert Hadfield referred to the fact that not so long ago there were English makers who did not even have analyses made of their products.

Prof. W. A. Bone dwelt upon the progress made in Germany and America, both of which he had visited. He said that about ten years ago he was at some of the large coke-oven installations in Westphalia, and was particularly struck by the amount of attention paid at Dalhausen and elsewhere to the investigation of the materials used in the linings of coke-ovens. He could not help comparing the character and extent of the work that was going on there with the practical absence of anything like it in this country. Later he saw something of the work that was being carried out by Americans. In connection with the process of combustion, generated from high temperatures, which he was then working at, he received much more help from the knowledge American investigators had gained than from almost any other quarter. At the Imperial College, his colleague Mr. Hancock and himself had undertaken some work upon materials for coke-oven linings and fire-bricks. This work was being pushed on as rapidly as the resources in materials, equipment, and men would allow. The variety of the problems which would have to be solved in connection with any really sytematic research on refractory materials was so great that no single institution, much less a single person, could possibly deal with them. Research would have to be organized. If any committee were formed to deal with the subject, it should be their first business to ascertain the present facilities of our laboratories for carrying on such work, and the people who were in a position, both by their knowledge and by the amount of time which they could give to it, to undertake the work. In the second place, work of this kind could not be carried on without considerable expenditure of money, and the industries concerned should very largely contribute towards the expense. He put forward a plea that the manufacturing firms who used refractory materials should subscribe liberally to the funds which were necessary. The Institution of Gas Engineers had done a great deal of useful work in the improvement of retorts; and the iron and steel industry should in the same way investigate the subject.

Prof. O. Arnold referred to the time when German refractory bricks were far superior to the British. He had been attacked in the Press for using German bricks in the Sheffield University; but the result was that British manufacturers had so far improved their products as to make them at least equal to German. When conducting experiments, he pointed out to the silica brick manufacturers that the chemical composition did not at all decide the quality of the silica brick, and that a grading of the particles of the ganister or siliceous material used was extremely important. The British manufacturers were obsessed with the idea of getting very large particles of ganister. The German bricks were very much finer in texture, and very much inferior in chemical composition, but yet superior in the furnace. As to research, they were not asleep in Sheffield University. The University had a scheme now before the Government which involved a capital expenditure of £30,000, and a revenue grant of about £3000 a year for research purposes; and this was still under discussion. The idea was that Sheffield should find half the £30,000 capital account, and the Government pound for pound. A laboratory for refractory research was one of the main features. He wished to utter a caution regarding some harmful nonsense found in certain text-books. In one it was stated that the melting-point of the silica brick was something under 1500° C. He thought the difficulty had arisen from the fact that the text-books were recording the softening-point of the bricks. They could be got to soften at 1450° C.

Mr. H. B. Ridge said the reason why the Germans had gone so

much ahead of us was that they treated their inferior clays scientifically, as well as the best clays. He had great difficulty in obtaining a continuous supply of suitably burned fire-brick from British makers. One point upon securing suitable fire-brick was the facilities that could be provided for testing. Arrangements must be made comparatively soon for erecting a plant where commercial tests could be carried out on a single fire-brick.

Prof. ARNOLD and Dr. ROSENHAIN both pointed out that facilities exist at Sheffield University and the National Physical Laboratory for testing at very high temperatures. A whole series of researches are being carried out at Teddington on refractories, which are, however, hampered by insufficient funds.

Mr. E. H. SANITER said the question of co-operation with other Societies was very important, and he would suggest that this should be extended to the Refractories Committee formed by the Institute. On the Committee the names of many well-known brick and refractory makers who were members of the Institute did not appear; if any success was to be hoped for, it was necessary to bring in the manufacturers as well as the users.

Prof. T. TURNER said that, coming from a district where there were over a hundred firms engaged in the refractory industry, he could safely state that at least half of them had no system of testing at all. Clay pits and clay works were in the hands of so many small firms, and on such a small scale—although the aggregate product was large—that it was necessary to introdnce science for practical purposes from the bottom, and allow it to be extended or increased as its value was shown. It would be absurd for a small manufacturer to have a laboratory and a man sufficiently skilled to do a complete analysis, when an analysis was only required occasionally. But the more simple tests ought to be done every day and recorded regularly.

Mr. W. HANCOCK remarked that in this country unfortunately the idea was prevalent that the ultimate chemical analysis of a refractory material was all that was required to arrive at some definite conclusion as to its qualities. Later experience had demonstrated that this was entirely fallacious. It was the physical properties of the materials which ultimately determined their value in actual practice. He was glad the author had drawn special attention to the subject of texture. It was perfectly easy, of course, to test the texture of raw and unfired plain materials; but what was wanted was to test the texture and structure of the actual fired material, as it came into use. This was an extremely difficult problem. Another important point to which the author had referred was that of abrasion, on which very little work had been done. They had, however, lately devised at the Imperial College a simple form of apparatus which enabled measurements to be obtained of the action that went on. With this it was possible to get abrasion tests of the material with comparative ease at working temperatures.

A BENZOL RECOVERY PLANT EXPERIENCE.

By D. R. W.

THE writer recently had a peculiar experience with a crude benzol recovery plant which is worthy of putting on record.

The benzolized oil entering the plant first of all passes through a preheater, in which it absorbs part of the heat latent in the benzol vapours from the still; the latter passing through a coil surrounded by the incoming oil. The oil leaves this heater at a temperature of from 80° to 90° C., and is further heated by means of a closed steam-coil in the superheater, from which it passes on to the still, where the last traces of "benzol" are removed by means of live steam.

It was found that the best results were obtained when the oil leaving the superheater was kept at a temperature of about 130° C. Some time ago, however, the temperature at this particular part of the plant began to fall, until (even with full steam on) it could not be got any higher than 105° C. This, of course, resulted in a "stronger" benzol being produced, with a corresponding fall in the production.

When all expedients had been tried, and no rise in temperature could be attained, it was decided to lay the superheater off, and examine the coil. This part of the plant being in duplicate, this was readily done, without having to shut-down. On taking out the coil, it was found to be covered throughout its entire length with a layer of about ⅛ in. thick of a dark grey substance, which, when exposed to the atmosphere for a day or two, readily chipped off. This substance was submitted to analysis, and was found to consist almost entirely of sodium sulphate, together with a little free carbon. This had evidently proved a very efficient heat insulator, and had prevented the transmission of the heat from the steam inside the coil to the oil outside.

The source of the sodium sulphate was soon traced. It had been the practice to put the "bottoms" from a washed solvent naphtha distillation back into circulation. Now as everyone who has had any experience of washing solvent naphtha knows, it always has a great tendency to form an emulsion during the soda washing. Evidently, each time solvent naphtha was washed, a little emulsion, containing sodium sulphate, formed by the neutralization of the sulphuric acid by the caustic soda, found its way along with the solvent naphtha into the still. This sulphate, of course, was left in the residue after distillation, and was run into circulation. On passing with the oil into the superheater, any that came into contact with the hot surface of the coil was immediately deposited. In this way, the layer of sulphate had been gradually built up. On cleaning the coil and putting it back into the superheater, normal results were once more obtained.

Needless to remark, since the above experience, "solvent bottoms" have not been put back into circulation.

DEVELOPMENT OF GAS-FURNACES FOR INDUSTRIAL WORK.

By THOMAS W. FLETCHER, Chairman of Fletcher, Russell, and Co., Ltd., of Warrington.

NOW that the attention of the gas industry is being particularly diverted to the utilization of gas-heated appliances for industrial purposes—especially for munitions of war—perhaps it will be of interest to some of your readers to know of some of the developments that have been made during the last thirty years or so by a firm that has specialized in this direction for well over that period. Unfortunately, until quite recently, little has been written on the subject since the death of Mr. Thos. Fletcher, F.C.S., the undoubted pioneer of such apparatus; and therefore records of much advancement in this direction have passed unnoticed.

To those who are familiar with the subject, it comes as a shock to read that, previous to the war, this branch of our trade was confined to the small experimental apparatus merely for laboratory work, and was not used to any extent commercially; also that the problem of creating a neutralizing or oxidizing effect in a furnace at will was an unsolved problem, and, again, that the utilization of waste heat in a second chamber was new.

To avoid the risk of unwittingly breaking the Defence of the Realm Act, or bringing the hand of the censor too heavily upon the author, he will have to give very indefinite accounts as to the real advancement in this direction. Taking one instance, however, the type of furnace now used in certain treatments during the processes of manufacture of both shells and cartridge cases, was designed by us and supplied to both the British and Allied Governments so far back as 1902. The same may be said of some gas-heated furnaces that are used in connection with certain processes in the manufacture of big guns. They were originally designed and supplied by our firm as long ago as 1904. They were of very considerable size even then; and the same principle and application are still the most approved. For small arms, bayonets, &c., we were still first in the application of gas for use in the most modern appliances of war.

We should like to give here our own unbiassed opinion, after many years' experience and research on the much discussed matter of high and low pressure air-blast and high-pressure gas when used in connection with gas-furnaces. Undoubtedly, when power is available, the most rapid and economical heating (together with the maximum heat) can be obtained by using a high-pressure blast coupled with an injector jet burner. Here one obtains the necessary velocity with a comparatively small volume of compressed air, as the supplementary supply necessary to perfect combustion is drawn in by the injector jet. The first application of this principle dates back as long ago as 1884. Low pressure is useful for general and slower heating. This is subdivided into two principles—either where the mixture takes place previous to or at the point of combustion. Theoretically, and provided one gets the proportions correct, there is little to choose between them; but should anything go wrong with the former, there is always the risk of getting an explosive mixture before the required point of combustion, which is a constant source of danger. This is quite avoided where the mixture takes place at the point of combustion. Either can be regulated by an automatic arrangement adjusted to the gas and air pressure available, so that a series of burners can be controlled by a single lever.

With regard to high-pressure gas, this is undoubtedly the most extravagant in use for high-temperature work; but if available it may compensate for the expense of putting down an air-pressure plant.

We merely give the knowledge of our experience; and by way of an example we give below the figures for melting Admiralty gun-metal, taken during actual daily work at a well-known works—not our own, nor under our supervision. These results are not selected, but taken haphazard from the works' journal.

Cyclone Crucible Furnace taking a 500 *lb. Crucible, Working with Air under Pressure at* 2½ *lbs. to the Square Inch and with Injector Jet.*

One week's work with one furnace; 35 heats; gas consumption, 58,155 c.ft.; Admiralty gun-metal melted and cast, 19,250 lbs.; average consumption of gas per pound of metal, 3·02 c.ft. Five melts in one day.

First melt .	4·60 c.ft.	per lb. of metal.	Time to melt, 2 hrs. 50 mins.
Second melt.	2·41	,, ,,	Time to melt, 1 ,, 35 ,,
Third melt .	2·09	,, ,,	Time to melt, 1 ,, 40 ,,
Fourth melt.	2·19	,, ,,	Time to melt, 1 ,, 20 ,,
Fifth melt .	2·40	,, ,,	Time to melt, 1 ,, 25 ,,

This gives an average of 2·27 c.ft. per pound of metal after the first heat.

We hope to give later a summary of the dimensions and consumptions of the largest of the various patterns of furnaces built during the last thirty years—showing the actual progress in this direction.

Calorific Standard Application and Orders Made.—An application has been received by the Secretary for Scotland from the Kirkintilloch Town Council for a Calorific Standard Order. The calorific power proposed is 500 B.Th.U. The Board of Trade have made Orders for the Ashton Gas Company and the Chester United Gas Company.

FRENCH HYGIENIC TESTS OF GAS-FIRES.

Critical tests of gas-fires, particularly of those used in domestic apartments, have been undertaken in a very thorough manner of late years, as evidenced, for example, by the paper by Mr. Hartley [see "Journal," Vol. CXXXII., p. 382] and that of Dr. E. Ott [see "Journal," Vol. CXXXIII., p. 89]. The measurements detailed in these papers, however, related for the most part to the thermal radiant and convective efficiency of different types of gas fires or stoves, and not by any means with the same fulness to the methods for the determination of the action of a gas-heating appliance upon the atmosphere of a room from the hygienic standpoint. These latter are almost exclusively the subject of a paper published in a recent issue of the "Journal des Usines à Gaz," with the object of placing before gas engineers precise tests which can be applied under given working conditions, and have, in fact, been adopted for a long time past by public bodies in France, among them the Central Coke Committee.

In the testing of a gas-fire from the hygienic standpoint, exact measurements require to be made of the effect of a fire upon the atmosphere of a testing-room. Such measurements include that of the production of carbon dioxide in the air of the room and also of carbon monoxide. They should extend also to the measurement of any carbon monoxide in the products of combustion. This last determination should on no account be overlooked, as a stove which can give rise to an appreciable quantity of carbon monoxide in the burnt gases is obviously more dangerous in use than one which cannot. Down-draught in the chimney may cause the products of combustion to pass into the air of the room—a possibility which should not be lost sight of.

In carrying out such tests as these, the room selected for the purpose should, as far as possible, correspond with average conditions. For example, there should be no excessive ventilation. Moreover, the draw of the chimney to which the stove is connected should be moderate, and be recorded in the test, and the closing of the room by doors and windows should be such as fairly to represent an average domestic apartment under these confined conditions.

Vitiation of Air by Carbon Dioxide.

The testing method consists in determining the proportion of carbon dioxide contained in the atmosphere of the room before and after the use of the stove for a given period. The difference then represents the extent of vitiation by carbon dioxide under the conditions of the experiment. The apparatus for the purpose consists of a tube about ⅜ in. diameter, fixed so that its lower and open end is about 5 ft. from the floor at the centre of the room. The tube is led from above into an adjoining room, where it is connected with a series of absorption tubes fitted in turn to an aspirator. The absorption tubes consist of: (1) A U-tube charged with pumice stone and sulphuric acid for the purpose of drying the air drawn from the testing room. (2) A Liebig potash bulb or similar apparatus containing strong caustic potash solution for the absorption of carbon dioxide. (3) A U-tube containing pumice and sulphuric acid for taking up any water carried over from the potash solution by the current of air. (4) A third drying tube (pumice and sulphuric acid), preventing moisture from the water in the aspirator finding its way into tube No. 3.

Tubes Nos. 2 and 3 are accurately weighed before and after each measurement. Tube No. 4 is connected to an aspirator, which may be of any convenient type. One such is a tubulated bottle holding about 12 litres (2 to 3 gallons), and filled with a mixture of water and glycerine. The upper tubulure is closed by a cork, through which passes a tube reaching to within ⅜ in. of the bottom of the bottle. The lower tubulure is provided with a tap, or a pinch-cock on a rubber tube, for regulating the outlet of the water at the rate desired. The liquid is collected in a graduated vessel, and the volume of air which has passed through the absorption apparatus is thus determined.

An aspirator which is preferable in many ways is that of Boussingault, made in zinc or galvanized iron. It consists of a cylindrical body to which, above and below, two conical portions are attached—thus permitting of the full contents of the vessel passing off by the lower tap. The latter has a tube extension-piece on it, the end of which is bent in the form of a hook, so that when the apparatus has emptied itself the air which has been drawn into it remains separated from the atmosphere of the room in which the aspirator is used. The upper conical part of the apparatus is fitted with a tubulure and cork, by which a thermometer is held within the apparatus, and indicates the temperature of the aspirated air. At the top of the upper conical portion a second tubulure and cork carry a tube which passes inside to within a short distance of the bottom, its upper end (outside) being connected with the series of absorption tubes. By weighing the apparatus when filled with water, and again after emptying it, its exact volume is determined.

In making a test, the room where the stove is being used is first thoroughly ventilated, and all doors and windows then closed. Meanwhile, tubes Nos. 2 and 3 are exactly weighed on a delicate balance, and put in position as described above. The flow of water from the aspirator is then adjusted by noting the rate at which the air passes through the potash bulb, and the apparatus is then left to itself until the aspirator is quite empty. The volume of gas V_0 at 0° C. and 760 mm., which has passed through the absorption tubes, is then given by the formula:

$$\frac{V\,(H - F)}{0{\cdot}76(1 + 0{\cdot}00367T)}$$

where V is the volume of the aspirator, T the temperature of the air in it, H the barometric reading, and F the maximum vapour-tension of water at T degrees. Tubes Nos. 2 and 3 are again weighed; the increase in weight (P) representing carbon dioxide. By dividing this weight (in grams), by the weight of a litre of carbon dioxide (1·97 grams), the result is the volume V_1 of the absorbed carbon dioxide. The quantity C of carbon dioxide contained in the unit volume of air is thus:

$$\frac{V_1}{V_0 + V_1}$$

This quantity in ordinary atmospheric air varies from 3·5 to 6 ten-thousandths. In Paris, the average is 4 ten-thousandths. This first measurement having been made, the gas-fire is lighted and adjusted to the maximum consumption; the time being noted when starting it. After the stove has been running for half an hour, a first reading is taken of the chimney draught by means of a manometer of the inclined-tube pattern, such as that of Péclet, which allows of measuring small reductions of pressure. As the glass is not readily wetted by water, it is best to use spirit with a little red dye in it in the manometer. The end of the manometer is connected by a piece of rubber tube to a right-angled tube fixed in the middle of the stove flue at a distance of about 1 ft. from the stove. The manometer reading is made hourly after this first observation.

After the stove has been in action for four hours, a second determination is made of the carbon dioxide in the atmosphere of the testing-room exactly under the same conditions and with the apparatus already described. This measurement thus gives a second figure C_1 representing the quantity of carbon dioxide in the unit volume of air at 0° and 760 mm. The difference between this and the previous measurement—*i.e.*, $C_1 - C$—indicates the vitiation by carbon dioxide per cubic metre.

In the case of a well-constructed heating appliance the extent of this vitiation should be practically *nil*. It may be taken as a practical rule that in a room of restricted ventilation and of capacity about 60 cb.m. (2120 c.ft.), the difference between the two determinations of carbon dioxide should not exceed 10 ten-thousandths, equivalent to the increase of carbon dioxide at the rate of 1 litre per cb.m. If a test results in a larger figure than this being obtained, it is well, before drawing definite conclusions, to examine the results as regards heating efficiency, as described in a later paragraph dealing with the examination of the products of combustion. The latter test will enable the operator to judge whether there is sufficient draught for the stove, and, if such is the case, excessive contamination of the air by carbon dioxide must be put down to too small a flue for the products of combustion or to bad design of the stove, with consequent incomplete discharge of the burnt gases into the flue. Examination of the stove will allow an opinion being formed on these points.

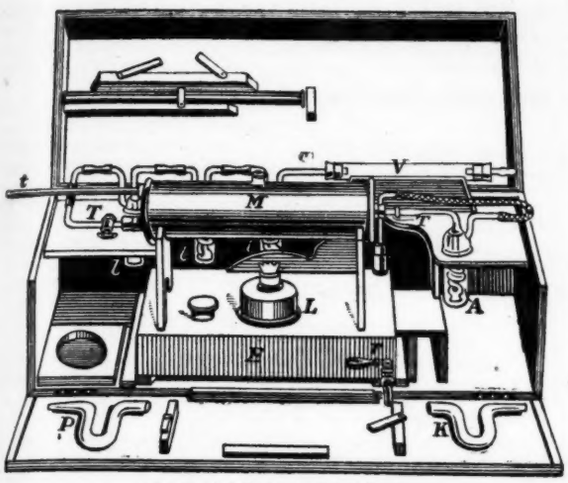
Vitiation of Air by Carbonic Oxide.

The method consists in passing a given volume of the air to be tested over chemically pure anydrous iodic acid, heated to 65°C. (150° Fahr). The carbonic acid decomposes the iodic acid, liberating iodine, which is carried forward in the current of air and absorbed by chloroform contained in a washing flask. The quantity of carbonic oxide is then determined by comparison of the colour of the solution so obtained with those of a set of standard solutions representing 1, 2, 3, to 6 hundred-thousandths of carbonic oxide per unit volume of air. A test is made in this way before the stove has been lighted—it should show no carbonic oxide—and then a second one four hours after lighting. The method is easily capable of accuracy to within half-a-hundred-thousandth—*i.e.*, 1 part in 200,000.

The arrangements for the test are exactly those already described for carbon dioxide. In practice, two similar tubes are rigged up in the testing room, and the two measurements can then be made at the same time. For carbon monoxide, the tube is connected (in the adjoining room) with a Pécoul-Levy or Goutal absorption apparatus.

The Goutal apparatus [see illustration, p. 287] consists, first, of a filtering tube V, containing moistened cotton wool, to which the air-delivery tube from the room is connected. The air next passes through three washing bottles, *l*, *l*, *l*, by which hydrocarbons, acid gases, and water-vapour are retained, and then proceeds by a glass tube, fitted with a tap T, to the absorption tube, charged with a mixture of pure iodic acid (25 grams) and glass wool. This tube is contained in a cylindrical copper water-bath M, heated by a spirit-lamp L. The temperature of the tube is indicated by the thermometer *t*. From the outlet of the absorption tube the current of air passes by a glass tube to the absorption bottle A, containing 65 c.c. of chloroform, covered with a thin layer of water for the avoidance of evaporation of the chloroform. The outlet tube from this bottle is, in turn, connected with an aspirator E, of 2300 c.c. capacity (half a gallon), the uprights on which form the support for the water-bath. By means of the tap *r*, water is allowed to escape at a rate suitable to the stream of air required.

Before a test is begun, the apparatus is freed from any traces of carbonic oxide or iodine vapour which it might contain. For



The Goutal Carbonic Oxide Test.

this purpose the spirit lamp is lighted, and the water-bath raised to a temperature of 65° C. A current of pure air is then drawn through the apparatus for ten minutes, regulating the wick of the spirit-lamp so that the temperature is kept at 60° to 65°. At the end of this time, providing there is no coloration of the chloroform, the aspirator is completely filled with water, connection made with the tube from the testing-room, and the test begun. The tap *r* is opened until air is seen to be bubbling through the absorption flask A at a proper rate. With a little experience, this is speedily adjusted. The water escaping from the aspirator is collected in a graduated vessel, and its flow regulated to the rate of 1 litre per quarter of an hour, equivalent to about 65 c.c. per minute. On completion of the flow of the quantity of water marked on the scale of the apparatus, the test is stopped, and the depth of the tint in the absorption flask compared with that of the standards from 1 to 6 hundred-thousandths. This test, as already stated, should record no carbonic oxide. If, however, the presence of this gas in the air of the testing-room is shown, it is necessary to discover the cause and remove it before proceeding further. After the stove has been in operation for four hours the test is repeated; the stove remaining in action while it is being carried out. The result of this test also should be negative. Writers on the subject have sanctioned a higher content of carbonic oxide; but the French view is that any heating appliance which produces even traces of carbonic oxide under a test carried out as described should be at once rejected. The fact should not be overlooked that carbonic oxide is an active poison, the effect of which upon red blood corpuscles is to paralyze their action.

Carbonic Oxide in the Products of Combustion.

The action of heating appliances in respect to the production of carbonic oxide in the burnt gases is too often neglected. Great importance is attached to it by the French authorities, on the ground that a stove which is defective in this way is much more liable to have injurious results. This caution is uttered specially in reference to stoves burning solid fuel and to those of slow combustion; but the question should be considered in relation to gas-fires, if only for the purpose of demonstrating the possibility of danger if proper arrangements are not made for the discharge of the products of combustion. In making tests of the burnt gases, the Orsat apparatus is useless. On the other hand, delicate methods, such as those of Pécoul-Levy and Goutal, cannot be used for quantities of carbonic oxide greater than 6 hundred-thousandths. But they are simple, rapid, and accurate; and therefore the following method has been devised, whereby they can be employed.

The flue is placed at a distance about 1 ft. from the stove, and a pipe inserted across its diameter. This pipe is closed at one end, and is provided along its length, or rather that portion of it which is placed in the flue, with a series of small holes, about 1·64 in. and about 3·16 in. apart. The tube thus serves for the collection of a portion of the products of combustion from all parts of the flue. It is about 1·16 in. internal diameter, is fixed air-tight into the flue-pipe, and is continued, by as short a length of metal tube as possible, to the adjoining room, where the Goutal apparatus is placed. The rubber junction with the Goutal should also be as short as possible.

The Goutal apparatus having been prepared for the test as already described, and the stove having been in action for about half-an-hour, the tap of the aspirator is cautiously opened, and the water allowed to escape very slowly, almost drop by drop, into the graduated vessel. The deepening of the tint in the chloroform flask is kept under close observation by putting alongside it the standard representing 4 hundred-thousandths carbonic oxide. As soon as it is seen that the tint is approaching that of this standard, the aspirator tap is closed and the amount of water in the graduate (= that of the aspirated air) read off. The rubber tube supplying the burnt gases is then disconnected, and, by opening the tap of the aspirator again, a current of clean air is passed through the apparatus for ten minutes for the purpose of sweeping every trace of iodine into the chloroform flask. This second operation slightly deepens the tint, which is then compared with the set of standards, and the quantity of carbonic oxide thus determined for the volume of burnt gases, V_1, which has been employed in the test. A simple calculation then gives the quantity corresponding with the quantity V for which the apparatus is constructed. Thus if the standard required for matching the tint obtained was 4·5, the correct figure will be:

$$\frac{4{\cdot}5 \times V}{V_1} \text{ hundred-thousandths.}$$

The execution of the test calls for much care and attention, and it is important to bear in mind that the method is suitable only for products of combustion which contain very little carbonic oxide—*e.g.*, those from a gas-fire.

Standards of Permissible Vitiation.

In proceeding to justify the standards of purity for the air of the testing-room which they adopt in respect to both carbon dioxide and carbonic oxide, the French authorities are influenced by a consideration of the physiological processes which take place in the lungs. They take as a basis the figures of Andral and Gavarret, that an adult of average weight in a state of rest consumes 10 to 12 grams of carbon per hour, and expires 18 to 22 litres of carbon dioxide—more than this quantity during physical exertion and less during sleep. They adopt also the figure of 4 p.ct. as the average proportion of carbon dioxide in the air expired from the lungs, and proceed to consider the marked and injurious effect upon the respiratory process of the presence of carbon dioxide above the normal proportion in the air. They point out that an essential factor in the process is the tension C of carbon dioxide in the blood which reaches the lung cells in comparison with that C^1 in the inspired air. C being greater than C^1, the carbon dioxide diffuses from the blood to the cell, while oxygen is taken up by the blood and revivifies the reduced hæmoglobin. There is thus a double current through the walls of the lung cells. But if the inspired air is already vitiated by carbon dioxide, the tension C^1 is greater, and the difference of tensions of the carbon dioxide in the blood and cell respectively is reduced, and the discharge of carbon dioxide from the blood to the cells is impeded up to a point when the tensions balance each other and there is danger of asphyxiation from accumulation of carbon dioxide.

They point out that this view is in accordance with the experience that asphyxiation from this cause is not relieved by the presence of a larger proportion of oxygen in the inspired air, while, on the other hand, the evil effects of carbon dioxide are aggravated by deficiency of oxygen in the inspired air. On these grounds, the maximum proportion of carbon dioxide, which is admitted as without harmful effect on the air of a room in temporary occupation is 24 ten-thousandths per unit volume—*i.e.*, 1 part in 460, or just under 0·25 p.ct. The meaning of this figure is illustrated by pointing out that it represents the degree of vitiation produced by the respiration of an adult of average weight in five hours in a closed room of 1760 c.ft. capacity. When the proportion of carbon dioxide rises to 80 ten-thousandths per unit volume (= 1 part in 120, or just over 0·8 per cent.), the air, according to Le Blanc, supports respiration with difficulty; while at 100 ten thousandths (1 part in 100, or 1 per cent.), it is dangerous to life. It is on these grounds that, in the tests made by the Central Coke Committee and the Paris Gas Company, the standard is adopted that in a testing-room of from 2000 to 2800 c.ft., the increase in the proportion of carbon dioxide during the use of a stove for four hours should not exceed 10 ten-thousandths (= 1 part in 1000, or 0·1 p.ct.).

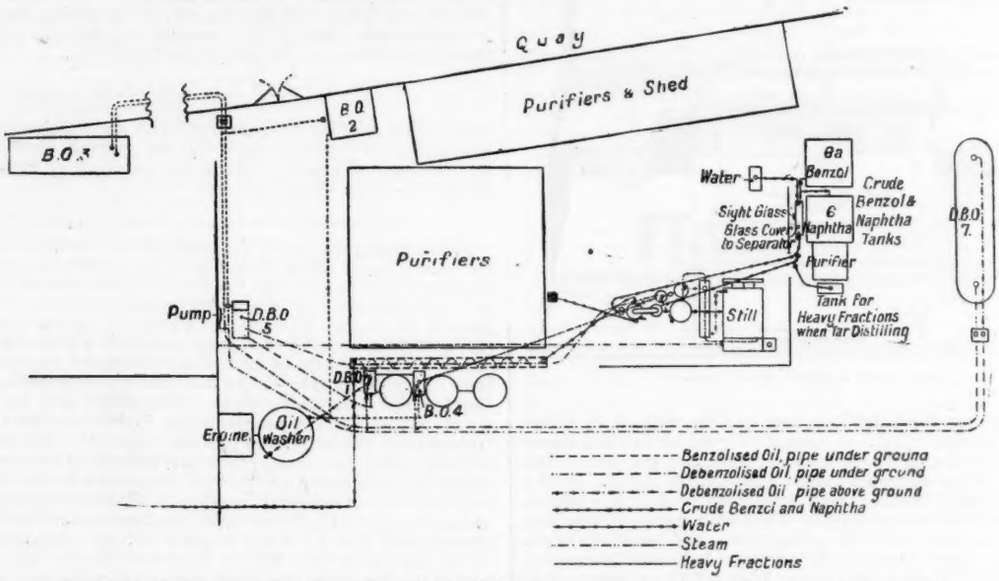
An even more rigorous standard is adopted in the case of carbonic oxide, in view of the experiments of Bernard and Le Blanc on the pronounced toxicity of this gas, the presence of which to the extent of 5 thousandths may be attended with fatal effects from paralysis of the blood corpuscles. In the case of the presence of the gas in very much smaller proportions, the result may be a slow poisoning, without the specific symptoms, but marked by a loss of appetite and colour, and calling for a prompt open-air cure in order to avoid more serious consequences. Hence the four-hour test already described should reveal complete absence of carbonic oxide in the air of the room. The extreme limit sanctioned by the Central Coke Committee is ½ hundred-thousandth (= 1 part in 200,000, or 0·005 p.ct.). The adoption of a much higher limit than this, as observed (so it is stated by certain of the French authorities) in the literature of other countries, is very strongly criticized.

In conclusion, on the subject of the evil effects of the use of a gas-stove without the proper removal of the products of combustion, figures are quoted to show the short time within which the air of the room oversteps the hygienic limit or reaches a degree of positive danger. The test was made in a room of 92 cb.m. capacity (3200 c.ft.), using for four hours a stove consuming 1010 litres (35 c.ft.) per hour. Allowing for the carbon dioxide contained in the gas (approximately 30 litres per hour), it is calculated that a proportion of carbon dioxide of 24 ten-thousandths (the adopted hygienic limit) is reached in just over 20 minutes, and that in an hour and three-quarters the proportion, in a room which did not permit of exchange of its contents with the outside atmosphere, would rise to 100 ten-thousandths—*i.e.*, to the danger point of vitiation.

BENZOL RECOVERY AT GORLESTON BY A MODIFIED DEHYDRATING PLANT.

By E. F. Keable, of Gorleston.

[A Paper read before the Eastern Counties Gas Managers' Association, May 3.]



PLAN OF THE OIL-WASHING AND CRUDE BENZOL PLANT AT THE GORLESTON GAS-WORKS.

Before giving my paper, permit me to say that I am not prepared to go into the financial side of the subject, as I feel this is just now the least important. The present position appears to me to be, "How can we recover the maximum amount of material needed for assisting in winning the war?" Beside this, all other issues are as nothing. Get the war over first, after which I for one feel certain that we shall have no need to fear the commercial prospect.

I attended a meeting at Norwich in May last, called by Mr. Glover to consider the question of increasing the production of benzol and toluol. Having a "Hird" tar dehydrating plant already at work, I at once considered the possibility of using this

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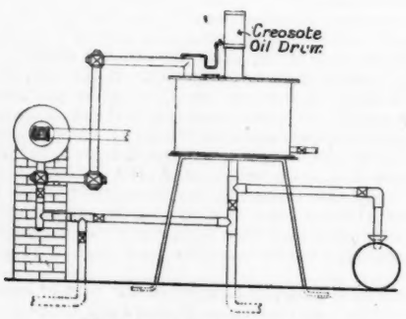
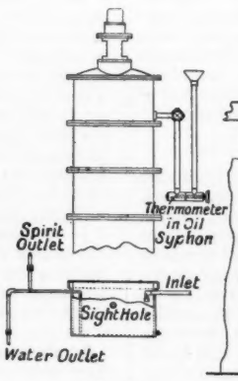
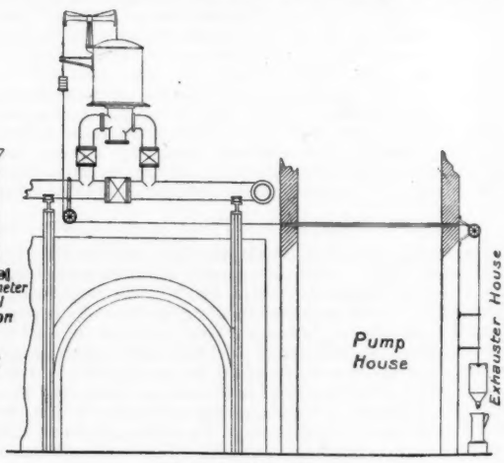


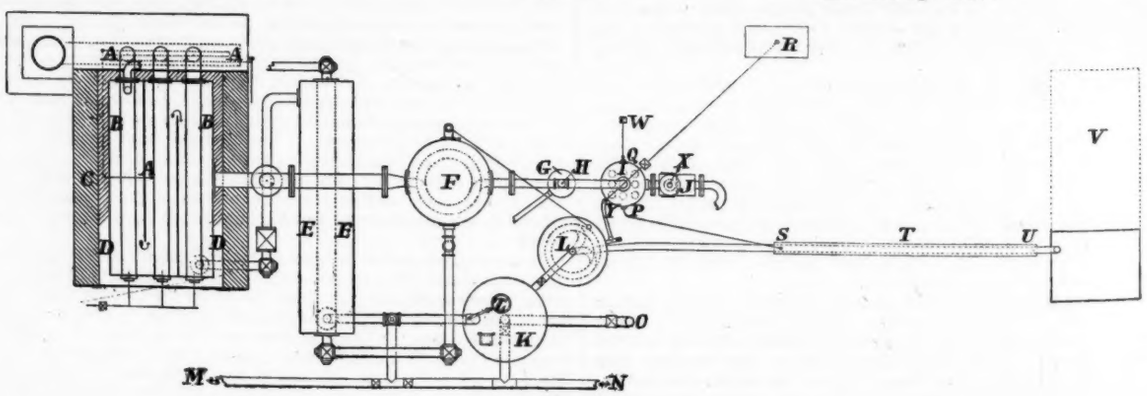
Elevation of Mixing Tank K.



Separator.



Water-Loading Device.



General Plan.

A. Steam Pipe. B. Still. C. Brickwork. D. Lagging. E. Heat Interchanger. F. Primary Condenser. G. Seal Pot. H. Fractionating Column. I. Benzol Condenser. J. Sight Box. K. Mixing Tank. L. Primary Oil Cooler. M. Oil to Tank No. 7. N. Tar to Well. O. Barrel-Filling Pipe. P. Water Inlet. Q. Water Outlet. R. No. 4 Feed Tank. S. Water Outlet from Cooler. T. Final Oil Cooler. U. Water Inlet to Cooler. V. No. 5 Tank. W. Gulley. X. Waste Gas to Purifier. Y. Inlet for Benzolized Oil. Z. Creosote Oil Drum.

for debenzolizing the wash-oil. I drew up a scheme to quickly, and at small outlay, alter the plant; and it at once received the patriotic and ready support of my Directors, thereby making its fulfilment not only a duty but a pleasure.

General Description of the Oil-Washing and Distilling Plant.

Seven tanks in all are in use. Starting in the direction of flow, their several uses are as follows: A suitable tank (No. 5) is sunk below ground to receive the tank-cart delivery of creosote oil. The oil from here is pumped to a main storage tank No. 7. From here it is raised by gravity into an 80-gallon tank No. 1, fixed to the feed washer. The tank contains a float; and by means of a weight passing over a gauge board the regular feed of oil per ton of coal carbonized can be regulated. In order to produce even results, this is important.

Washer Used for Extraction.

The washer in use is a Kirkham, Hulett, and Chandler centrifugal. After removing the last traces of ammonia in the bottom three trays, the top four are fed with creosote oil at the rate of 50 to 60 gallons per ton of coal carbonized. We have found that by adding one tray to the original working—thereby allowing the gas a longer time-contact—better results have been obtained. Frothing over, as at first experienced, has been overcome since an extra tray was added, by draining the debenzolized oil away from the washer by means of a run-off cock at the bottom of the last oil tray.

Prevention of Water Trouble in the Oil.

A thermometer is fitted in the syphon conducting the oil to the washer; and by using one for the gas also differences in temperatures can be watched, and water trouble in the oil avoided by keeping the temperature in the oil above that of the gas. During the winter months this is accomplished by feeding-tank No. 1 supplying the washer with warm stripped oil from tank No. 5. By this method oil at the syphon has usually been from 5° to 6° above the gas. After leaving the washer, the benzolized oil passes by gravity to tank No. 2. Each day, before starting to strip, the contents of this tank are pumped to the main benzolized oil-storage tank No .3.

Distilling Plant.

The still is fed from here by a further 80-gallon tank, No. 4. This also has a float, &c., and feeds by gravity. The rate of flow can by this means be both controlled and recorded in a way which is impossible by a pump feed. Regularity at this point is not only desirable, but necessary. After passing through the still, the hot debenzolized oil is cooled in the following manner: The oil passes through the heat interchanger, and then into the coil of a home-made cooler, and is here reduced in temperature some 30° by the counter-flow of the incoming benzolized oil. At the outlet of this cooler it passes through a final water cooler formed by a straight pipe passing through four lengths of 3-in. cast-iron pipe below ground. Water in this pipe is flowing counter to the hot oil.

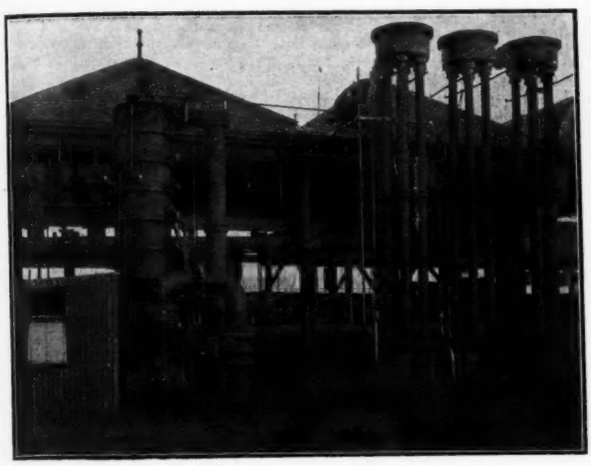
We have an abundant supply of cold well water for cooling purposes. This is necessary; otherwise benzol would be lost to the purifier, and the stripped oil insufficiently cooled. The water ultimately falls into a sight funnel, and away to waste. The cooled oil then falls by gravity into tank No. 5. From here it is pumped into tank No. 7, having completed its cycle. All the tanks are linked by pipe-lines, and the necessary pumping is done by a double-acting wall pump specially made for the purpose by Messrs. Evans and Sons. In order to avoid any mistakes, it was decided at the outset that the operator should know the tanks by numbers. Further, all suction valve wheels are painted red and deliveries white.

Additions to Original Dehydrating Plant.

The distilling plant was originally erected by Messrs. Hird, Chambers, and Hammond for tar dehydration. The alterations and additions to these are as follows: On the outlet of the original condenser there has been fixed a fractionating column, one end of which is sealed in a pot having a suitable overflow; the top end being attached to the water-cooled tubular benzol condenser. On the outlet of this condenser is fixed a sight box, having an outlet for crude benzol to tank No. 6A, and at top for waste gases to a small lime purifier. These additional parts have been supplied by the original makers of the plant. The more recently erected plants made by this firm are at the outset fitted in this way.

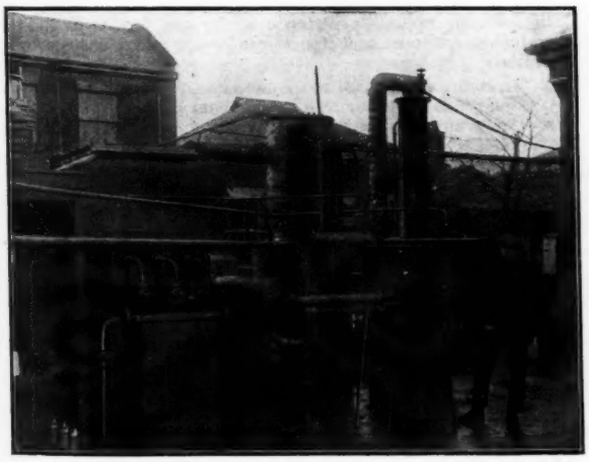
Steam for the Still.

A supply of live steam has been added to the still. At first two

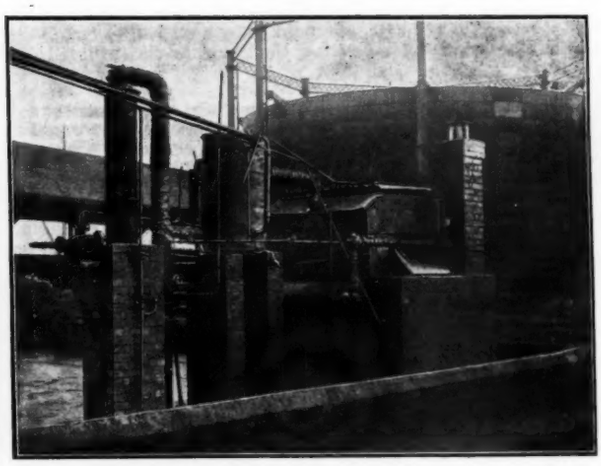


Oil-Washer and Feed Tanks.

Crude Benzol and Naphtha Storage Tanks; also Separator.



General Front View of Plant.



General Back View of Plant.

supply points were in use, each having a cap in which two small holes were drilled. These we found soon became blocked, and in place of these one central supply has been fixed in the crown.

Means of Superheating Steam.

Steam is caused to pass through the waste-gas flue on its way to the still. The steam-pipe in the flue passes backwards and forwards three times, finally passing out at the crown, at which point a valve and branch for the steam pressure gauge are fixed. In order further to superheat the steam as much as possible, the three iron flue elbows at the rear of the still are lagged and encased in sheet iron, thereby throwing as much heat as possible into the flue containing the steam-pipe. The steam-pipe passes through the still lagging and, entering the still at the centre of the crown, reaches to within 3 in. of the bottom. Arrangements have been made to remove it easily when a tar run is on.

Method Employed for Conserving Heat.

As the entire plant stands in the open, it was necessary to lag wherever possible. The original or primary condenser is lagged, and thus plays an important part in heating the benzolized oil on its way to the still. As arranged, the incoming benzolized oil is first raised in temperature by hot stripped oil, further by benzol vapours passing through the coil of the primary condenser, and finally by the stripped oil passing counter through the heat interchanger. Before entering the still, the oil is thus raised in temperature to about 70° C. The entire still is lagged by means of slag wool between the brickwork; and it is interesting to note that although our plant is shut-down at night, the temperature in the still next morning is usually between 26° to 37° C. When benzol distilling, the crude spirit from the condenser and seal pot unite prior to entering the separator; the spirit going forward to tank No. 6, and the water, after being measured, to the liquor well. A sample of liquid taken prior to the separator usually shows half-and-half.

Steam Consumption.

The steam used in the still is equal to an evaporation of 10 lbs of water per gallon of spirit produced. In making the separator we found it necessary to fix a plate-glass lid in order to avoid loss of benzol by evaporation. This further affords a ready means of watching the flow. A glass sight-hole in the side of the separator is used for keeping the level of the spirit and water constant.

Preparations for Alternate Tar and Benzol Runs.

Suitable valves are fixed so that when tar distilling is in progress the heavy fractions from the seal-pot at the outlet of the primary condenser collect in a separate small tank—the light oils going forward to the separator to be collected in tank No. 6. Thus by collecting separately the value of the plant in this direction will be improved. To assist in easily changing-over from tar to oil, or *vice versâ*, pipe line connections have been laid to empty the plant of its contents, while either the tar or the oil is still hot.

Results.

The plant was originally made to deal with approximately 600 gallons of tar per day; but for debenzolizing wash-oil we find it capable of dealing with from 70 to 80 gallons per hour. It has therefore not been necessary to work at night, and we arrange to have the washer feed tank pumped up as required during the night by a stoker. With the still temperature at 129° C., steam pressure up to the controlling valve (60 lbs. per square inch), and oil passing at the rate of 70 to 80 gallons per hour, we have produced on an average 2 gallons of spirit per ton of coal carbonized, containing, on an average, 68 p.ct. at 120° C. The oil is saturated to 5 p.ct.—this being found the best point for our working. The debenzolized oil usually shows only 0·20 to 0·80 p.ct. at 180° C. The rate of feed to the washer and distilling plant is recorded hourly, as is also the temperature of the still and steam pressure. Samples of spirit, benzolized, and debenzolized oil are taken at frequent intervals during the day. These are tested for the quality of the spirit, the percentage saturation of the oil, and the stripping efficiency of the still. We have used from the start a light creosote oil of 1·02 sp.gr. (4° Twaddel), low in naphthalene content. Being light, its life is lengthened, and so far our entire parcel of oil has not been changed; but we have at intervals added fresh oil.

Effect of Oil-Washing on Sulphur Compounds, &c.

Referring to the action of the wash-oil on sulphur compounds by testing the gas on both the inlet and outlet of the oil-washer, we find that these are reduced by the process some 27 p.ct., thereby materially assisting subsequent purification. The process has reduced the illuminating power of the gas about 23 p.ct. and its calorific value about 5 p.ct. The plant has now been at work about five months, and its working has occasioned little or no trouble—in fact, it has become to us so much a part and parcel of our ordinary routine that we have almost forgotten that its advent is of recent date.

Effect of Oil-Washing on Consumers and Districts.

This account would be incomplete without reference to the effect of the process on the consumers and district. So far our consumers have given us very little trouble indeed; and having got through the first five months, we do not anticipate much trouble during the light portion of the year. It appears that most users of our gas now fully realize that this war is only going to be won by a liberal supply of high explosives, and most consumers are quite prepared to suffer any slight inconvenience. Our aim, however, has been to make and distribute a gas of even value as far as possible; and to this end we have controlled the quality of the gas manufactured by a simple home-made water-loading device attached to the retort-house governor and, further, by a photometer supplied direct off the outlet of the exhauster. The object, expressed in a few words, is to pull at the proper period of the charge and allow water to automatically gradually lessen the pull as the charge becomes spent. On the district have been fixed (side by side) a Beasley recording calorimeter, a Peebles jet photometer, and a Bray "special" flat-flame burner. These keep us in constant touch with the value of gas being supplied to the consumers.

Naphthalene.

Naphthalene has never troubled us upon the district, either before or since oil-washing. Our total complaints covering stop pages or checks of all kinds in the mains and services for months during which the process has been at work, compared with corresponding months of previous year, are as follows:

	1915 and 1916 (Before Oil Washing).	1916 and 1917 (After Oil Washing).
November	17	7
December	18	15
January	14	24
February	14	7
March	4	11
Totals	67	64

From the start of the "C" process we have used a solvent to safeguard against possible trouble. The solvent used is prebenzol. This is dropped into the main by a syphon at the outlet of the station meter at the rate of 1 gallon per 100,000 c.ft. of gas made. This was at work quite a year before starting to oil-wash; and from what has been brought out in recent discussion, it is necessary to have mains, &c., clear of old deposits of naphthalene at the outset. We propose during the coming summer to apply a stream of water to our first set of atmospheric condensers, in order to ensure a better condensation, and thereby lessen the chances of naphthalene next autumn.

As an inducement to our collectors and fitters to push the sale of incandescent burners, we are allowing a small bonus for each one sold. This keeps them eager to push the sales, and also to tackle any complaints as they arise. Where the sale of an incandescent burner is impossible, we supply a Bray's "Special" flat-flame burner free of charge; and from these, excellent results are obtained.

Points Requiring Attention.

In summing up, our experience so far has taught us that, if good results are to be expected, the following points require close attention:

1.—In laying down plant spare no pains in making every joint, for which purpose use blacklead and knotting.
2.—Allow ample tankage accommodation when the plant is to be used for both tar and wash oil.
3.—Keep water out of the oil, as freedom from this makes all the difference in results in both the washer and the still.
4.—Keep the feed to both the washer and the still regular.
5.—Superheat steam and keep a close watch on the amount used; otherwise the quality of the spirit will soon become affected.
6.—Keep the working temperature of the still both adequate and regular, to ensure low spirit and water content in the stripped oil.
7.—For safety and good returns, keep the plant sealed wherever possible.
8.—Use cold well water for cooling, if available.

It is to be hoped that many present will be induced to join the ranks of those who are trying, at this critical stage in our country's history, to supply that which she so much needs. By so doing you will not only materially assist in winning the war, but will be placing yourselves in the best possible position in respect to the trade war which will follow.

DISCUSSION.

The President (Mr. John Terrace, of Grimsby) said he was sure the members had listened with great pleasure to the paper Mr. Keable had read. He might suggest that the discussion should not be confined too closely to the question of the working of the plant at Gorleston; but the paper might very well be made the ground for mentioning any difficulties that had arisen in connection with oil or tar washing, or in their other manufacturing processes due to the changes brought about by the exigencies of the war.

Mr. J. H. Brearley (Longwood) complimented the author upon the very lucid manner in which he had put before them the details of the plant at Gorleston. He could not speak from practical experience of the use of plant of this particular type, either for oil debenzolizing or tar dehydration. But he had followed very closely the technical development of this form of still and similar stills. From knowledge of the plants in his district, he could say that the results Mr. Keable was getting were very satisfactory indeed. The yield of 2 gallons per ton of coal was very good working; but if the author attained to anything much higher than this figure—even 25 p.ct. higher—he was afraid he would find, although he now had immunity from naphthalene troubles, difficulty in this respect would soon begin. Upon this

point, he noted that Mr. Keable did not say much about the naphthalene content of the creosote oil, except that it was low. He was to be congratulated on this, because everyone was not so fortunate as to get creosote oil delivered from the distillers with such a low naphthalene content as to give them freedom from worry. The paper laid stress on the importance of keeping water out of the oil as much as possible; and it should be emphasized as being equally important that they should keep the naphthalene out as much as possible. A good deal of the naphthalene troubles that had occurred since the introduction of oil-washing had been due to the naphthalene in the creosote oil, and was attributable to allowing the creosote oil to fall to a lower temperature than the gas it was washing. They must take care that the creosote oil was at a higher temperature; otherwise there was great danger of the gas, while being denuded of the carriers of naphthalene, taking up naphthalene from the oil. It was essential, therefore, right at the beginning, that everyone should render himself thoroughly familiar with the physical considerations involved in the process. This done, the risk of trouble was diminished. If there was naphthalene in the creosote, it was important to try to get as much of it out as possible. He had made himself familiar with the method his nephew had with great success introduced at Swinton. By it, he was able to extract a considerable proportion of the naphthalene from the oil after it had been used, and then it was ready for re-use. He congratulated Mr. Keable upon his idea of giving a small bonus to his fitters for pushing incandescent burners; and he also complimented him upon his acumen in not going to the extent that was done in one other famous seaside resort—of supplying incandescent mantles practically free of cost. He did not think there was any need for gas undertakings to go to that length. He thought a little encouragement to the fitters, or being on good terms with the ironmongers, would go a great deal farther than making things too cheap. Very often cheapness was considered synonymous with nastiness; and they should be very careful they did not lay themselves open to such a charge. He should like to explain that the reason he had not a plant of the kind described in the paper was that he was working vertical retorts; and he believed the authorities were not very anxious for gas from verticals to be washed. If this were not so, his Company would be quite ready to take up anything necessary in the national interest.

Mr. H. G. RUGGLES (Leighton Buzzard) remarked that his Company in December last put down a plant for oil-washing the gas; and therefore they had been working practically the same time as Mr. Keable. There were one or two points upon which he should like some information. Since commencing operations, they had had great trouble with the thickening of the wash-oil. This might be due to the fact that, instead of using creosote, they were employing green oil of a high specific gravity and viscosity. They also had a loss of wash-oil. The running of the plant commenced at the beginning of the year; and at the present time they had only about 50 p.ct. of the wash-oil left. He was now considering the question of renewing, with the result that he thought it would be better to renew with a light creosote than with a heavy green oil such as they had been employing up to the present. The plant he was using was a breeze-fired one; and taking it altogether, it had been working very satisfactorily. In March they were able to get 3 gallons of crude benzol per ton of coal carbonized. They had had some stoppages, owing to the delivery-pipe from the still to the dip becoming blocked with anthracene oil. Due to the same cause, they had also had trouble with the water-cooler. He believed it had been found in other cases that the amount of cooling area provided was insufficient. They started their working at a still temperature of 120° C.; and they found, by raising it to 170° C., they got much better results. In regard to naphthalene troubles, they had, he was glad to say, been very free from them up to the present.

Mr. W. W. TOWNSEND (Colchester) congratulated the author on the amount of crude benzol produced per ton of coal; but, of course, the benzol produced in the tar should also be taken into consideration. It seemed to him that Mr. Keable's condensation was not very efficient or drastic; so that some of the benzene which, in ordinary circumstances, would be contained in the tar, was available for the washing oil to extract from the gas. This, to some extent, might account for the high figure. At Colchester, they condensed very drastically, and put as much benzene into the tar as they could; and so they could not get such a high figure as Mr. Keable in the washing process. He inquired if the author had had any trouble from tar fog. In most places the washing was done after the ammonia was extracted. It was preferable, he thought, to put the washer after the purifiers; then they got absolutely clean gas. In some cases, at any rate, if they used part of the washing plant for this process they got the washing-oil contaminated with tarry matter. Had Mr. Keable experienced any trouble of this kind? If so, had he done anything to overcome it? He noticed there was a fractionating column applied to the plant; but the author did not say what became of the condensate from the column. Was it returned to the still, or was it mixed with the crude benzol in the condensing coil, or was it separated and the naphthalene got out of it? It was a most important point. It would also be interesting if they could have some idea of the quantity of steam used for distillation. This was a plant in which they had a certain amount of direct heat from the furnace, and a certain amount from open steam; and he supposed there was some rule by which the proportion of open steam was arrived at. He should like, if possible, to know what it was. Another point was that it would be interesting to know how long it took to instal the plant, because some who had been considering putting down a plant of the kind had been discouraged to find that other colleagues had had to wait from four to six months to get the apparatus installed. He hoped Mr. Keable managed to have his at work in a shorter space of time than this. Another thing that struck him about the plant was that Mr. Keable had made very little provision for the water cooling of the oil. Nearly everywhere, he believed, there had been trouble in keeping the oil down to a sufficiently low temperature. Mr. Keable simply had as his final cooler a few lengths of 3-in. pipe with water passing round the pipe containing the oil. He had told him personally that up to the present he had found this satisfactory; but he (Mr. Townsend) doubted whether he would find it so during the coming hot weather. He had up to now been working the plant during cold weather; and, unless he had some means of cooling the gas, the efficiency of the plant would go down very much during the hot weather, because the temperature of both gas and oil would go up. He believed it was a fact that the efficiency depended a great deal on the temperature. If they were washing the gas with the oil at 80°, they would not get the same efficiency as if the oil was at 40°.

Mr. H. J. RANDALL (Yorktown) said they had at Blackwater a Hird-Chambers tar-dehydrating plant. When asked by the Ministry of Munitions what they could do with oil-washing, the point arose as to the adaptability of the plant in connection with creosote oil washing. In his experience with dehydrating tar, he found there was great liability to what was called "blobbing" or excess of pressure in the still; and with the labour in his part of the country, he could not face the risk of washing with creosote oil with a breeze-fired furnace. Mr. Carr had kindly supplied him with a drawing of the Bankside plant; and though he quite admitted Mr. Keable's method of dealing with his plant was much cheaper, still he maintained it was better to put in a steam-heated still as an extra vessel in dealing with creosote oil washing. By doing this, they had been able to maintain their temperatures more readily; and although they had not the wonderful figures Mr. Keable had, they were over 1¼ gallons per ton of coal carbonized, and he hoped to get higher. One of the speakers had asked whether Mr. Keable had any trouble with tar fog. This raised a point which many of them had had to face, and would have to face if they were thinking of adopting creosote washing. At his works, they had a small condensing plant and washing plant; and it was simply a question as to whether they would be able to adopt the process owing to the small area. Fortunately, his late colleague, Mr. Fisher, at the Tottenham works had, with a colleague, devised a plan of dealing with the tar fog; and they allowed him to make a test of it. He manufactured it out of his own materials. It had eliminated the whole of the tar fog; and he was able now to use his rotary washer quite successfully. The plant consisted of a rectangular box, let into the foul main between the retort-house and the exhausters. The inlet and outlet pipes were taken in near the top of the box. In the box plates were fixed so as to make a funnel-like opening through which the inlet gas passed. Two split conduit pipes were carried through the box, fed from the outlet of the exhauster; and by these a certain amount of gas, regulated by suitable cocks, was brought back (in their case) under a pressure of 17 in. In this way, they had gas under pressure blowing through the gas under partial vacuum. By this means they found the whole of the tar was brought down before the exhausters; and they had been able to work very successfully in this way. He believed Mr. Broadberry had similar plant in action at the Tottenham works; but he (Mr. Randall) mentioned it as being useful to those in charge of small works.

Mr. F. M. PATERNOSTER (Felixstowe) said the paper was very interesting to him because he had seen the plant at Gorleston. When Mr. Keable promised to read the paper, there were one or two points to which he (Mr. Paternoster) had hoped he would allude, and which were rather important. He hoped he should not be considered unpatriotic in mentioning them there that day. The author said in one place that this account would be incomplete without reference to the effect of the process on the consumers. He was hoping to see in the paper a statement as to what was the make per ton of coal previous to starting the process and what it had been since. Mr. Keable said he had had little trouble with his consumers; but had he reduced the make of gas per ton, and had the quality of the gas been kept up? When he (Mr. Paternoster) visited Gorleston, Mr. Keable showed him the gas with a special Bray burner and an ordinary flat-flame burner; and it seemed to him that the flame with the ordinary flat-flame burner showed that the gas was quite good. He was wondering whether Mr. Keable was "making-up" to his consumers by reducing the production of gas per ton. They had to a certain extent to look at this sort of thing from the financial point of view, though pressed to provide as much benzol and toluol as they could to assist in carrying-on the war. But if—and this was the point of his inquiry—they were going to continue the process after the war, they must look at it from the financial point of view. If they had been getting 12,500 c ft. of gas per ton of coal, and they adopted this process to extract benzol and toluol, and found that, to satisfy consumers, they had to reduce the make per ton to 10,500 c.ft., he did not think it was going to pay them.

The PRESIDENT remarked that Tottenham was one of the early places to adopt oil-washing; and by a peculiar set of circumstances, Tottenham also used vertical retorts, and yet were washing by oil. They had there not only a Hird-Chambers dehydrating plant, but a Wilton dehydrating plant; and both had been used for debenzolizing the oil. A coke-oven type of debenzolizing plant had also been installed. They would like to hear from Mr. Wardell as to any point he considered of general interest in connection with the various methods of working. Mr. Paternoster's questions were after his own heart. One of the points that he wanted to make in his address (without putting it too strongly) was that they were rather inclined in their discussions to make pretty little speeches, and to be too much afraid of saying anything of an aggressive nature, or of poking their noses into figures which people would not disclose. But in all business, figures were the thing they should be clear about. He thought they ought to be prepared to discuss fully and freely what their makes and conditions were. There were one or two points in the paper that had a bearing upon this. One was the method used for regulating the quality of the gas. Personally, he had never been one who could believe altogether in varying the pull of the exhauster according to the quality of the gas coming off, because it always seemed to him that, if the plant was properly proportioned, they ought to have the same pressure in the retorts all the time. If the pressure in the set of retorts which were newly charged necessitated the running of the exhauster faster, surely under these conditions they must be putting an undue vacuum, or too little pressure, on the other retorts. They had seen a good deal lately about the reduction of calorific and candle power by adulteration. In this connection, he felt that the first point they were up-against was the unsatisfactoriness of the test for nitrogen. He was discussing this point only the previous evening with Mr. Broadberry; and next morning he was going to Tottenham to see the test made there for nitrogen, as up to now he was not satisfied with any method that was used. The point was that many people

might be sending out a quite good calorific power gas, but which might come under the description of a diluted gas by over-pulling and drawing-in furnace gases, or too much air at the purifiers. This was a question that had cropped-up again recently. Of course, they could argue both sides of any question. They were told, on the one hand, they must save all the coal they could; and it would hardly seem conducive to this if they suddenly dropped from 12,500 to 11,500 c.ft., because they discovered that they had got more diluents in than they should have. But this question of big makes had, he thought, been pushed to the extreme.

Mr. R. Wardell (Tottenham) was surprised to find that Mr. Keable extracted 2 gallons of benzol per ton of coal carbonized, and that the reduction of calorific power was only 5 p.ct. Possibly Mr. Townsend had put his finger on the secret of this when he referred to Mr. Keable's condensation.

Mr. Keable, in replying to the discussion, thanked the members for the way they had received his paper. As to the question of the pull, he had only pulled at the right end of the string. He could only say that since the method had been in force, they had received payment for two lots of gas accounts; and the best test was that the customers had made no complaints. Regarding the question of the nitrogen content of the gas, he could not go into this at present. As to the naphthalene content of the creosote oil, the British Gas Light Company supplied the latter; and all he could say was that Mr. Glover assured him that the naphthalene content was low. He (Mr. Keable) had found nothing in the working to lead him to the contrary conclusion. Respecting Mr. Ruggles' remarks, he had had no experience of green oil, so that he could not answer his question. As to the loss of oil, they had found one going on. This was to be expected. In their case, when first starting washing, they had trouble with frothing-over; and they lost a considerable amount in this way. But figures would be misleading; and he could not say exactly what the loss had been. It would, of course, be proportionate to the amount found in the spirit. What Mr. Townsend said about condensation was no doubt, in his (Mr. Keable's) case, very real indeed. They were unquestionably in that particular "undermanned;" and he intended to improve this side of the working during the coming summer. On the point of tar fog, they had an Everitt tar-fog extractor on the inlet of the condensers; and since putting this small piece of apparatus to work, the question of tar fog had not troubled them to an extent worth speaking about. They used to have trouble on the first purifier; but since the plant had been at work, they had had no trouble in this direction. Mr. Townsend asked a question as to where the contents of the fractionating column got to. They united prior to entering the separator; and the spirit thrown down at this point mixed with the spirit thrown down by the seal pot. Here, again, Mr. Glover happened to be the supplier of his oil, as well as the buyer of his spirit; and it was bought on an analysis basis. Up to the present, they had dealt with upwards of 4000 gallons; and the price of the spirit had been maintained right through. Mr. Glover was keeping close watch on the quality of the spirit. As to the time taken in installing the plant, they were early in the field. Immediately the Company decided to instal it, the Ministry of Munitions gave them an "A" certificate right through; and so they had no trouble in this respect. In regard to the oil-cooler, if they were recirculating the oil to the washer direct from the tank on the outlet of the plant, he could understand Mr. Townsend's remarks. But the oil was first pumped into the 80-gallon tank which fed the washer; and as it took about two hours to circulate through the washer, this gave the oil a certain time to cool in the 80-gallon tank. As to what the summer would bring forth, this was a point which would have to be looked to. If trouble cropped up, they would simply transfer the oil from tank No. 5, which was the outlet of the plant, back to the main storage No. 7; and by recirculating in this way, and with the possibility of adding another cooler, they would get over any trouble that occurred. Mr. Randall also raised the question about tar fog; and he had answered that the make of gas per ton had not been reduced since the process was adopted; but owing to the war, they were now using a mixture of Yorkshire and Derbyshire coal, as against seaborne Durham coal previously. This rather altered the condition of things for comparative purposes.

On the motion of the President, seconded by Mr. Townsend, a hearty vote of thanks was passed to Mr. Keable for his paper.

An Appeal for the Use of Gas and Coke.

The Ministry of Munitions wish to impress on the public the desirability of limiting in every way possible the consumption of raw coal for industrial and domestic purposes. It is pointed out that the valuable bye-products of raw coal which are essential for munitions of war and for food production are recoverable only when the coal is dealt with at gas-works, or otherwise under proper conditions. Accordingly, wherever circumstances permit, coke and coal gas should be used instead of raw coal for steam-raising, heating, and cooking purposes. The Ministry are aware that many manufacturers and householders find it difficult to obtain coke; but efforts are being made to enable gas-works to consume a smaller proportion than hitherto for their own requirements, and it is hoped that in this way the supply available for the public will be substantially increased. With regard to steam-raising for industrial purposes, it has been found, as a result of trials with different boiler installations, that, under proper conditions, coke, or coke and raw coal mixed, is as effective as raw coal alone.

Oil-Washing and Debenzolizing.—After the "Journal" went to press last week, we noticed an error in the paragraph under this heading on p. 226. It occurred in the words: "In cases where the trouble in cooling the benzol is very acute," &c. "Benzol" should, of course, read "debenzolized oil," as is apparent from the words preceding: "The makers of benzol-recovery plants should make sure that the debenzolized-oil cooler is efficient for summer temperatures."

FOUR HUNDRED B.Th.U. GAS.

By C. B. Tully.

It is satisfactory to know that nearly twenty years' labour on the production of a cheap diluting gas has not been wasted. Some twenty years ago the Directors of the Sligo Gas Company (at that time they were making only about 12 million c.ft. of gas per annum) voted £150 towards the cost of erecting an experimental water-gas plant.

A simple plant was constructed, and worked for some years. The water gas made was mixed with coal gas as required up to 25 p.ct., and sometimes over; and the mixed gas was carburetted with benzol or naphtha up to 16 candles. This mode of working was found to be very useful and satisfactory. Then the late Prof. Vivian B. Lewes came along with his methane-hydrogen process. Permission was asked, and readily obtained from the professor, to make use of his invention; and the plant was altered for the purpose. Prof. Lewes's idea was to crack hydrocarbon with steam (or in an atmosphere of steam) in a water-gas generator for the production of hydrogen, methane, and carbon monoxide. Having absolute confidence in Prof. Lewes's theory, and of ultimately being able to put his theory into practice, all manner of experiments were tried, and large sums of money as well as much time expended. One by one, the many difficulties were overcome; and it was only lately (unfortunately since his death) that his idea has been satisfactorily solved in a very simple way.

Prof. Lewes visited Sligo and made several test runs with his plant. The resnlts were so satisfactory that it was decided to continue the investigations. The line of action he advised at that time was to produce a gas of about 400 B.Th.U. with a CO content of not more than 20 p.ct.; and this is what was aimed at.

There is no doubt that Dellwik's plan of blowing through a shallow bed of fuel to complete combustion is the correct one. It was with the object of going one better than Dellwik that the methane-hydrogen generator was designed. In this generator, use was made of the hot waste gases to heat-up the upper bed of fuel and a superheating chamber, for superheating the steam or cracking oil (should it be desired), instead of blowing them to waste as Dellwik did. The economy of this arrangement is obvious. With this design of generator, it has now been found quite possible to make from house coal a methane-hydrogen gas of 400 B.Th.U., containing not more than 20 p.ct. of CO.

To make a gas of this composition, hydrocarbons must be cracked-up into hydrogen, methane, and carbon. In this case the hydrocarbons of the coal are cracked-up, with a resulting reduction of the CO, and an increase of methane. Tar can be used with coke, and the same object attained. The use of tar in the generator is not to obtain an illuminating gas, but simply to act as a diluent of the water gas to reduce the CO.

However, it is not possible in the ordinary water-gas generator to completely crack-up hydrocarbons into their elements of carbon and hydrogen, with the result that the gas resulting from the cracking of a hydrocarbon will contain, besides hydrogen and methane, a good foundation of luminous hydrocarbons. It is gas of this composition that has been so successfully mixed with coal gas—that is, genuine coal gas, not stretched gas, but gas of 600 B.Th.U. and over. Such gas as this mixed with 50 p.ct. of methane-hydrogen gas of 400 B.Th.U. will give a good clean useful gas of 500 B.Th.U.

This is not the last word, however; and 500 B.Th.U. gas is not the ideal gas. What is wanted, and what has been successfully made and distributed for the past ten months, is a gas of 400 B.Th.U. containing 18 to 20 p.ct. of CO—a gas that can be used in stoves and incandescent burners without the worry and annoyance of the bunsen burner. In fact, something that the consumer can use simply by opening and turning a tap. This wipes out the most objectionable feature of modern gas supply—namely, the bunsen burner.

This gas has been tested in all kinds of cooking and heating stoves, geysers, gas-engines, furnaces, oxy-furnaces, also for metal cutting and welding with oxygen, and for lead burning. For this purpose, the gas is used without air—simply the gas under pressure. It has a reducing action on lead, and good sound clean work can be done.

The gas is washed and purified with oxide of iron only, and is practically free from sulphur, which is a most important point in gas required for all industrial purposes.

Mr. Enright, of Tralee, has been working on the same lines, and confirms the experimental work at Kingscliffe. It is to be hoped his son's plant at Bandon will soon be installed, when further data will be available.

Output of Coal in South Africa.—H.M. Trade Commissioner in South Africa (Mr. W. G. Wickham) reports, says the "Board of Trade Journal," that, according to information furnished by the Commissioner of Customs and Excise at Pretoria, the output of coal in the Union in 1916 amounted to 10,073,473 tons (of 2000 lbs.), valued at £2,715,313, which is a considerable advance on any previous year. In 1915, the output was 8,281,324 tons, valued at £2,142,479. During 1916, 2,164,262 tons of coal were bunkered at Union ports, and 565,636 tons exported as cargo.

SOME WARTIME ALTERATIONS OF WORKS.

By H. E. Bloor, B.Sc., B.Eng., of York.

[A Paper Read before the North of England Gas Managers' Association, May 5.]

The modernization of an old gas-works always comes as a difficult and anxious problem to an engineer who has to work the new plant himself. On the financial side, many delicate problems arise; and the decision as to whether the case is one in which wholesale demolition and reconstruction *de novo* will pay better than the utilization of existing plant with the addition of modern equipment, deserves prolonged analysis and consideration before any irrevocable step is taken.

The problem presents itself in all degrees—from a completely new works on a fresh site downwards; and its solution for the York works occupied me during the first year of my appointment as engineer of the undertaking. My plans were ready for acceptance in principle by my Directors at the time war broke out.

The course mapped out contemplated the almost complete regrouping or rebuilding of the works by a gradual process calculated to occupy from ten to fifteen years, at the end of which time it was hoped the works would present the appearance of having been designed as a whole—a feature which is lamentably lacking in many old works.

The basis of the scheme was the erection of vertical retorts in a portion of one retort-house, with provision for extension as required; the peak load being dealt with meantime by means of existing hand-stoked regenerative settings. It was hoped to place a contract in October, 1914, for completion during the following summer. On the outbreak of war, my Directors took the view that the war would be long, and need the raising of an army on a Continental scale; and as this clearly involved a withdrawal of labour on a large scale, it seemed to be hopeless to attempt a big scheme with a fixed time-table such as would have been essential in this case. Even without this consideration, finance would have been a determining factor, in view of the presumed impossibility of raising capital.

My Directors had no doubts as to the absolute necessity of adopting some means of reducing the labour requirements of the works, and resolved to proceed with one of the alternative and smaller schemes previously prepared, and to a description of which my paper is mainly devoted.

The scheme contains insufficient novelty to justify its description before a technical body in ordinary circumstances; nor does it represent in any way my solution of the problem of carbonization, either in principle or in detail. I have, therefore, thought it necessary to explain at some length how it came into existence as a forced war measure designed to meet a contingency which actually occurred, and which could certainly not have been dealt with had action been deferred.

Modification of the Old Works.

The York works are divided into two parts by the River Foss; both portions being served by an overhead railway crossing the river by a bridge. The carbonizing plant in the newer portion consists of twelve direct-fired settings, each setting having eight oval retorts with circular mouthpieces. Although the retort-house is a very fine building, the bad foundation and other considerations rendered it impossible to reconstruct the carbonizing plant on modern lines; and the house has accordingly been placed out of action, and attention concentrated on the old works.

The old retort-house was constructed for direct-fired settings, and later adapted as a basement house for twenty-one regenerative settings of eight Ω retorts 22 in. × 15 in. section × 18 ft. long. There are two furnaces to each setting. The principal dimensions of the house are: Length 308 ft., width 54 ft., distance from walls to mouthpieces 16 ft. 6 in., height to springing of the roof 21 ft. There are four benches—three of six arches and one of three arches; the arches being 10 ft. 2 in. centres and 8 ft. 3 in. from floor level to crown of arch.

Each hydraulic main was originally provided with a separate seal regulating tank which was intended to act as an unbalanced tar tower. The arrangement was very imperfect; and one of the first alterations made was to fix tar-towers and retort-house governors. Unfortunately, the arrangement of cross joists carrying the mains only permitted of a fall of 1 in. per setting in the 8 in. tar-mains; and as would be expected keeping these mains clear has proved difficult. One of the methods used was to maintain a constant flow of liquor through the hydraulics; and advantage was taken of this to work the tar-towers in what is believed to be a novel manner. A 2-in. pipe with a valve was connected to the tower about 1 in. below the weir; and by closing this a few minutes before commencing the charge, the dip-pipes were sealed. When charging was almost completed, the valve was opened and the dips unsealed. The system worked quite well; but has since been discarded in favour of working with the liquor just touching the dip-pipes, and a level gauge to 1-10th vacuum maintained in the retorts.

Occasional steaming keeps the mains fairly clear; but my experience shows conclusively the need for as much fall as possible in the tar-mains, and a large outlet from the hydraulic. Our outlets are 4-in.; and I should never fix less than 8-in. in future.

The governors are 12-in., and were supplied by Messrs. J. & J. Braddock in 1913. They have given no trouble of any kind, and the bells are still quite sound.

The Retort-House Plant.

At the outbreak of war most of the work outlined above was completed—a fortunate circumstance, in view of the necessity of equipping the retort-house with labour-saving machinery. Contracts were placed in January, 1915, with Messrs. W. J. Jenkins and Co., Ltd., of Retford, for a combined stoker coal-breaking and elevating plant and two overhead coal hoppers. It is gratifying to be able to state that the contractors had the plant working on the guaranteed date, July 1, 1915. The plant consists of a breaker of Jenkins design, of 50 tons per hour capacity, fitted with a wipe-off automatic feed. A small hopper, 7 ft. square at the ground level, centrally situated under the overhead rails, supplies the feeder, which is provided with 1¼-in. square holes, which partially screen the coal.

I should like specially to emphasize the fact that the breaker and elevator are belt-briven. My original intention was to adopt gear-and-chain drives; but I can never be sufficiently thankful that I did not do so—a circumstance which is entirely due to remembering the result of the conflict at a gas-works in which I am interested between a positive drive and a piece of wagon lining.

York experience may be unhappy in this respect; but the quantity of metal found in our breaker far exceeds anything I had thought possible; and the plant would certainly have been put out of action several times but for the safety-valve effect of the belt-drive. The breaker pit is 20 ft. 6 in. deep, in virgin clay throughout, and lined with brick walls set in cement. The elevator is of the ordinary bucket type, having a capacity of 50 tons per hour.

A special feature of the elevator is the fact that it is practically a "D.B., chain, with buckets attached. It was adopted on the suggestion of Messrs. Jenkins, and has given every satisfaction, working with perfect smoothness and noiselessness. This form of construction is a marked improvement on the usual skidder-bar design, and can be confidently recommended. It is 61 ft. high, and together with the breaker is driven by a 29 H.P. motor.

As would be supposed, the circumstances effectually prevented the adoption of continuous coal hoppers; and it was resolved to instal two separate hoppers. A small hopper, holding 30 tons, was decided upon for the direct delivery from the elevator; while a 70-ton hopper is provided at the middle of the building, served by a belt conveyor, 24 in. wide, carried externally on the roof principals and housed in a wooden tunnel. Advantage was taken in both cases of the exceptional structural strength of the building and chimney, and the excellent foundation on which it is built. The 70-ton hopper is carried by two steel joists of H section, 20 in. × 7½ in., let into the chimney base at one end and supported on the retort-house wall at the other.

The combined "D.B." stoker is of the usual type, and no trouble has been experienced with the charger. Some difficulty was found at first with the pusher—mainly in connection with the eccentric cam trip mechanism regulator, which depends on the binding force of two bolts. Relief was obtained by inserting hard-wood blocks, which prevent the bolts from shifting; and the pusher is now entirely satisfactory.

To save the expense of renewing the chain, I have used bushes made by turning ¾-in. steam-tube to 1-in. diameter and finishing off the bore with a file. These form a great improvement, and an old chain can be repaired and made better than new in this way, at negligible cost.

The order for the De Brouwer hot coke conveyor, the hoppers, and the coke gantry was placed in March, 1915; and the first portion, consisting of the hot-coke conveyor and hoppers was completed and working on Jan. 26, 1916—some delay having occurred owing to the dislocation of affairs generally during that period. The conveyor is of the usual De Brouwer type, and is 3 ft. wide × 334 ft. 8 in. long, with flat cast-steel push-bars.

There is a space within the retort-house, about 40 ft. in length left vacant for extensions; and advantage was taken of this space to overcome the difficulty caused by lack of room outside the end of the house—the hopper being perforce accommodated in the roadway between the retort-house and the offices.

The conveyor accordingly commences to rise at the end of the retort-bench at an angle of 35°; being supported midway on the gable-end wall, delivering into a screen 3 ft. 4 in. diameter × 26 ft. long and revolving at 12 revolutions per minute. No trouble has been experienced with the rather sharp angle of the conveyor.

The screen was originally designed to work at eighteen revolutions; but through an error it was found to make twenty-two revolutions. By reversing the sprockets, the revolutions were reduced to twelve; but the screen easily deals with the coke. Three separate sections of the hopper were provided, to take the screenings through ¾-in. and 1½-in. mesh and large coke; but the intermediate size has been temporarily abandoned, and only breeze and large coke are now made. Some complaints of the smallness of coke have been received. They are few in number; and every effort is made to satisfy consumers with a genuine grievance.

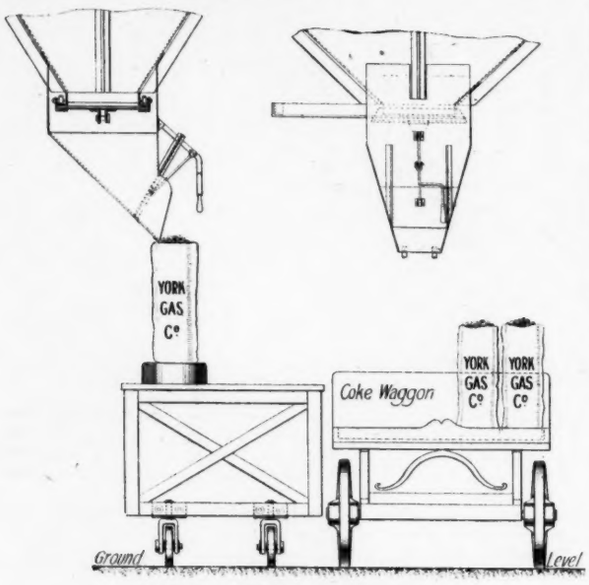
The trouble is twofold. In the first place it is necessary to empty the hoppers, or practically so, every shift, The first lot of coke from the following shift thus falls the full height; and it is only when the hoppers are half-full that the coke can be said to be reasonably treated. In the second place, I am satisfied considerable separation of the large pieces takes places in the act

of falling; and at certain times the whole of the coke drawn from the hoppers is in large lumps.

I believe the breakage could have been greatly reduced, had this part of the installation been much larger, so as to obviate the necessity of starting each shift with a clear hopper. The point did not escape me in designing the plant. I was, however concerned to reduce the magnitude of the job to a minimum, in order to facilitate manufacture and erection; and though experience has confirmed the opinion that the coke-hoppers are too small—accommodating, as they do, only 50 tons of large coke—I have no reason to doubt the expediency of the policy pursued.

Coke Shoots.

As originally designed, the coke shoots to the hoppers were double; but at an early stage the use of the long shoots filling bags at the floor level and lifting on to lorries was found unsatisfactory, and the coke also tended to hold-up in the shoots. I accordingly designed and made coke shoots of a new type. These are roomy, and operated by a simple lever working a slide. The shoot is very accessible; and coke can be released instantly by the operator if any holding-up occurs.



Arrangement of Coke-Bagging Shoots.

The height is suitable for loading carts; and the bags are filled on a wheeled platform. There is thus no lifting-up of bags; and bagging with this arrangement is very rapid and quite easy work—being performed by women with the assistance of an employee who has lost an arm in the war. Thirty bags can be filled and loaded, and the cart ready for weighing in from five to six minutes—a very important point in York, when a relatively large amount of coke is sold in bags.

Conveying Coke to the Producers.

A small point in the design of the conveyor is worthy of notice. Owing to the fact that each setting has two producers, it is necessary to wheel coke to feed the machine side producers. In order to provide a supply of coke within the retort-house, the conveyor is provided with a flap-door at a suitable height; and coke can be dropped on the floor or direct into handcarts. In practice, it has been found impossible to feed the producers on the conveyor side with coke direct from the conveyor, owing to the design of the producers and feeding doors. Cold coke is, therefore, used throughout, and special men attend to this portion of the work.

As originally designed, the coke conveyor was drained through a perforated cast-iron plate into a sump, the clearing of which was a source of trouble and expense. I have since altered the arrangement, and the water now drains from the side of the trough and runs direct to the drains by way of a shallow channel constructed of two courses of bricks and provided with a few perforated transverse plates. The system answers perfectly, and the channel is emptied daily without expense by the retail coke man; the dust being used up in the producers.

Coke Slacking.

Our coke appears to require a large amount of slacking; and the use of a great number of sprays was so wasteful of water that I experimented with several automatic sprays, and ultimately one was evolved which I consider entirely successful. The tap used is of the gland variety, as all ordinary plug taps were found useless owing to leakage, and the hoop lever shown has been found least liable to foul the coke. The spray is formed very simply by means of an adjustable cone in a short piece of 1 in. pipe. It can easily be cleared, and the cone of water made to fit the trough perfectly. I attribute to this spray the fact that so far there is no sign of unequal lengthening of the conveyor, the bars of which are still quite at right angles to the trough. Any of the sprays can be put out of action by simply turning the lever into the vertical position.

While dealing with the coke conveyor, I should mention that on one occasion the chain ran out of the tension-wheels for no apparant reason. The falling weights bent the bolts by which they are carried, while the sagging chain fouled a cast-iron lug on the wall plate, with the result that eleven bars were broken. The resulting repair was a serious operation; and the accident might have had grave consequences had a length of chain not fortunately been in stock. I have now removed the cast-iron lug referred to, and fitted a satety device designed to catch the shaft of the floating pair of wheels. It is adjustable, and comes into operation when the wheels fall an inch.

Such an important breakdown as occurred the first time is now impossible; and I regret that a similar device was not provided in the original design, as the possibility of such an accident did not occur to me.

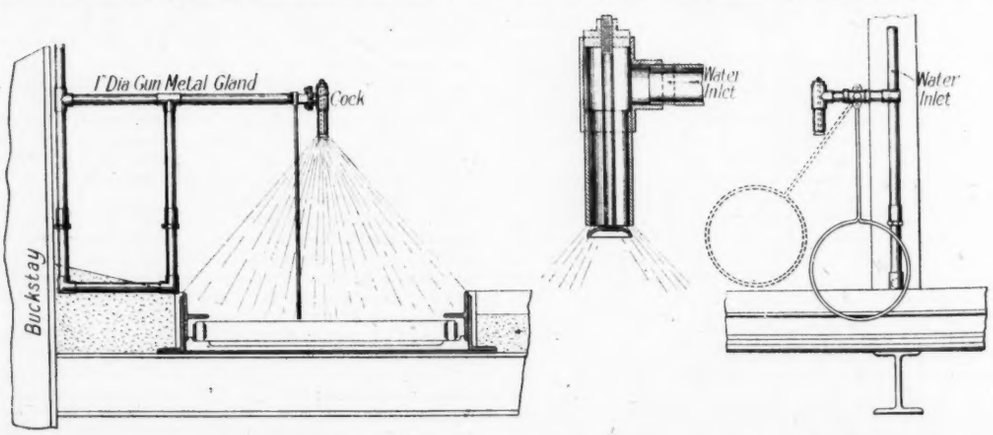
The coke hoppers are constructed throughout of mild steel supported on cast-iron columns; and, in view of the visible wear on the bottom plates, I am arranging to line the hopper bottoms with cast-iron plates ¾-in. thick and bedded in cement.

The Coke Gantry.

Construction of the coke gantry was seriously delayed, owing to the requirements of the Ministry of Munitions, and it was only completed a few weeks ago. It was specially designed to meet the peculiarities of the site and works. The only available coke store is a long narrow yard between the retort-house and the boundary wall. In this area are four wells—two long rectangular and two circular. All are very strongly covered with brick and concrete arches, and the foundation is quite exceptionally good. The coal store runs at right angles to the retort-house, and extends to the boundary wall; and it was desired to take advantage of this to enable coke to be put into wagons or into stock, as required.

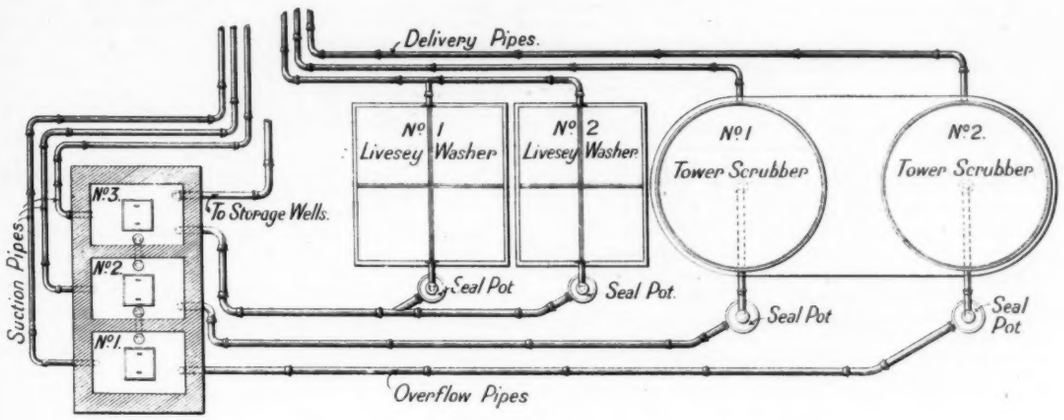
I should have liked to instal a telpher plant, but the height and consequent weight and expense of this construction prevented such a course. In these circumstances I conceived the idea of an overhead electric railway running along the hopper side, and thence right through the coke-yard and into the coal-store at a suitable height to fill railway wagons on the same line of rails on which is the coal-tipping point.

The loco motor is of 15 h.p.; the gauge, 24 in.; gradient, one in eighteen; length of track, 431 feet. The current is taken from two trolley-wires supported by brackets bolted to the joints

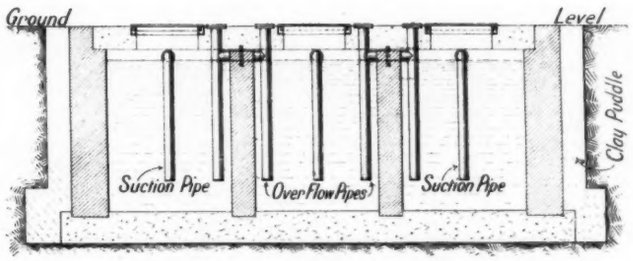


Cross Section. Front Elevation.

Water Spray for the Hot-Coke Conveyor.



PLAN.



CROSS SECTION.

ARRANGEMENT OF LIQUOR CIRCULATING WELLS.

carrying the rails. The arrangement has not been a success, owing to the fact that insufficient clearance was left between the wires; and the brackets being built-up of flats, are too weak and easily bend. As a result the frame carrying the trolley arms fouls the brackets occasionally, causing "shorts," which are a serious inconvenience. It is proposed to replace the whole arrangement by overhead wires, and, with this alteration, the gantry will be entirely successful.

The locomotive will readily pull two bogies up the incline, each loaded with 10 cwt. of coke; and when the locomotive has been loaded and provided with stronger brakes it is intended to handle three bogies. A round journey occupies some five minutes. The standards carrying the gantry are arranged as far as possible to miss the underground wells; and in those cases in which this was impossible, a reinforced concrete raft foundation was made, extending between two pier walls. Old steel purlins bent to a suitable shape furnished the reinforcement.

About 2000 tons of coke can be stored with a little raking-down; and it is hoped in future to dispense entirely with the expensive cartage and stacking in the other works, which has always been necessary hitherto.

The electric power is obtained on special terms from the Corporation supply. The current is 460 volts direct; and an undertaking was entered into by the Corporation to give a preferential supply in case of strike or accident to any of their plant.

THE RECONSTRUCTED RETORT-HOUSE.

Returning to the retort-house, I regret to say that continuous difficulty was experienced with stopped ascension pipes, to such an extent as seriously to imperil the supply of gas. No effective cure was discovered; and in view of the bad condition of the mouthpieces, the expensiveness of working and excessive wear and tear of the machines consequent upon the small charges possible with such little retorts, I took an opportunity of rebuilding six settings as sixes with retorts 24 in. × 18 in. of dished ⌂ shape. Three of these settings were segmentals; and they have proved so satisfactory that I have now adopted this system generally.

As a preliminary to resetting, it was necessary to replace the original buckstays and cross joists. The buckstays were of 6 in. × 1¼ in. flats, and were too weak, and together with the cross stays bent all shapes. Buckstays 12 in. × 6 in. and joists 10 in. × 6 in. to carry the hydraulic main were installed successfully; and with careful packing no disturbance of the retort-house floor seems to have occurred.

A hydraulic main of a new type, which has since been protected by myself and my assistant, Mr. J. B. Fenwick, was fitted at the same time. The special object of the design was to avoid the necessity of tar-mains, and to permit of the easy removal of deposits of thick tar. The main is in one continuous length of 60 ft.; and it slopes 2½ in. per setting to the tar-tower. Division plates between each setting allow any setting or settings to be left-off; and the main can be carried over the end of the bench and a connection taken direct to the tower. This was not possible in the particular bench equipped with the new main, from which a short 8-in. pipe connects to the tower. The cover plates for the open side of the main are dished, and seal in shallow lutes, to prevent or reduce to a minimum the loss of ammonia. There is only one main on this bench, on the machine side. All ascension pipes are 8 in.

Our experience with regard to stopped pipes is excellent; but after about six months' working, using a 5-in. augur each charge, I found a deposit was taking place round the sides of the pipes. I accordingly designed a special cutting augur, 7-in. wide, for the purpose of keeping the bottom end of the ascension pipes quite clear. As this augur is very good, and easy to handle owing to its lightness, I submit a sample for inspection. We can now keep these pipes perfectly clear. Exact level gauge is maintained in the retorts; and there has been no thick deposit in the hydraulic main, which is kept almost perfectly clear.

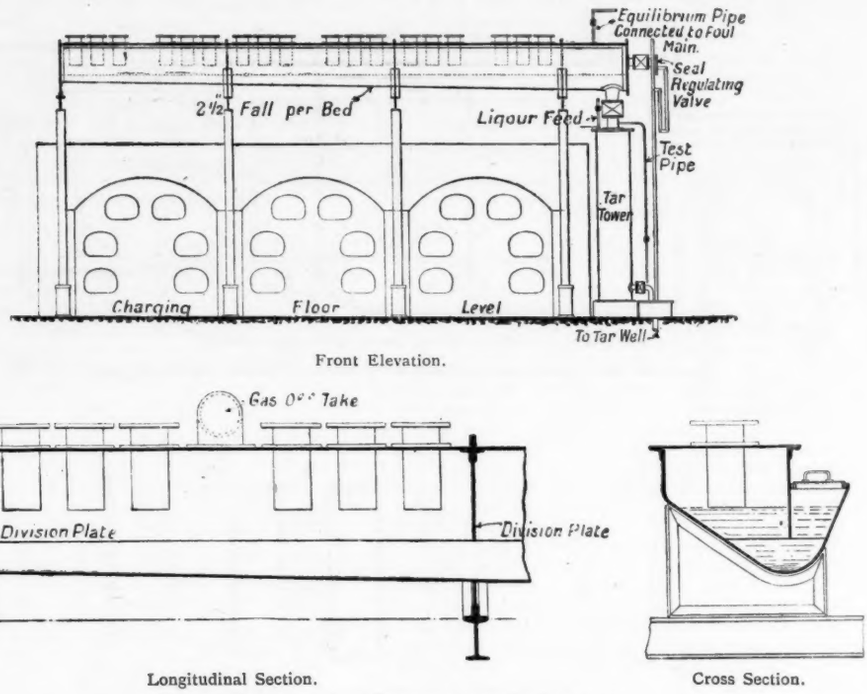
GENERAL REPAIR AND IMPROVEMENT WORK.

In addition to the alteration of the carbonizing plant, a very large amount of general repair and improvement work has been carried out during the period of the war; but I will only refer to two improvements which may be of interest. Our tower scrubbers were worked in a peculiar manner. The weak liquor ran into a small sump, and overflowed to wells situated a considerable distance away. Liquor for the first scrubber and the Livesey tar-washers was pumped from a sump filled by gravity from the tar wells and liquor ran direct back to the wells. With this system, it was impossible to work-up the liquor to a satisfactory strength; and the capacity of the scrubbers was only from 1,000,000 to 1,200,000 c.ft. of gas per day. It is a peculiarity of the works that, though the carbonizing plant is capable of an output of 2,000,000 c.ft. of gas a day, the subsidiary plant was designed for only about 1,000,000 c.ft.; so that it used to be necessary to use both works for six months in the year. The system of connections was altered so as to permit of working the old works' retort-house to its maximum capacity, and utilizing the new works' purifiers. A necessary preliminary was to render the old works ammonia plant equal to the full production of the retort-house; and this was effected by constructing a set of three small wells, each 6 ft. × 4 ft. × 6 ft. deep.

The fresh-water scrubber is now provided with a set of sprays, half-way down, through which liquor is circulated from the first well. The overflow from this well (equal to the fresh water supply) goes into the second well, which supplies the first scrubber; and the overflow into the third well is circulated through the tar washers. The system will comfortably deal with 2,000,000 c.ft. per day so far as scrubber and washer capacity is concerned; but the small connections give considerable back-pressure.

Before 2,000,000 c.ft. per day can be dealt with continuously, it will be necessary to still further deepen the syphons. The liquor from the condenser runs direct to the wells at present; but arrangements are almost complete for passing this liquor into the first scrubber well, so that its value for purification may be utilized.

The carburetted water gas plant is situated on the new works,



ARRANGEMENT OF CONTINUOUS HYDRAULIC MAIN.

and consists of two sets of a rated capacity each of 750,000 c.ft. per day. I have recently replaced the ordinary form of chequer bricks in one of these machines with the Davison-Tooley patent brick. The reduction of pressure due to this type of brick is such that the altered machine is now quite capable of making 900,000 to 1,000,000 c.ft. per day with 17-in. blast pressure. The other machine has been altered by fixing a 22-in. stack-valve, and an 18-in. down pipe, in place of the 17 in. and 15 in. respectively originally supplied. Stoke holes, 15 in. by 24 in., were also fitted in place of the very narrow stoke holes supplied with the plant, which is a very early one of the "Economical" type.

It is hoped to obtain a considerably increased production by the alterations; but as this machine has not been required during the past winter, I am unable to give any figures. There is without doubt, a great loss of efficiency with the small stack-valves and down-pipes which were originally fitted in most of the early water-gas sets; but the alteration to modern sizes is very simple and not costly.

DISCUSSION.

The Acting-President (Mr. William Hardie) said he had been greatly interested in the paper, because it was valuable at this time to hear something about work of construction. He agreed with Mr. Bloor when he said the course mapped-out contemplated the almost complete regrouping or rebuilding of the works by a gradual process calculated to occupy from ten to fifteen years, at the end of which it was hoped that the works would present the appearance of having been designed as a whole. It was necessary that they should look forward to what they were ultimately going to do. It was no use doing (say) a little bit of patching every six months, unless they had a scheme as a whole in view. The thing was to look well forward, as Mr. Bloor said, twelve or fifteen years, and try and get a scheme which could be easily added to, and at small expense. They would notice that Mr. Bloor did not omit to tell them of the difficulties and inconveniences he had had in his experience; and this was something they could all appreciate. They had all had their difficulties; and to hear what had been done to avoid them was of interest to every member.

Mr. C. Dru Drury (Sunderland) congratulated Mr. Bloor on the courageous and original way he had tackled the difficulties of the situation. The question of stopped pipes cropped up in the paper. The formidable auger that Mr. Bloor exhibited no doubt effected its purpose very well; but it seemed an awkward instrument to wield. On the assumption that prevention was better than cure, it seemed that it would be more to the point if they could prevent stopped pipes rather than try to clean them. He had never seen Mr. Bloor's arrangement for handling coke. The electric railway seemed to meet the case. It not only stored the coke but filled it into wagons; and therefore he assumed that Mr. Bloor had some means of screening the coke. Regarding ascension pipes, his (the speaker's) experience was adverse, no matter what size they were, unless they kept them clear. His works had a series of steel hoppers; and in case of breeze obstruction on the plates—which was severe at times—they found the reinforced concrete lining gave complete satisfaction.

Mr. T. Hardie (Newcastle) said Mr. Bloor's paper dealt with practical difficulties which appeared in gas-works, and showed how these difficulties had been met. He was particularly interested in Mr. Bloor's coke-handling scheme, because this was the method they adopted at his (Mr. Hardie's) works a good many years ago. They had altered their conveyors; and this had met several of the difficulties they had at the commencement. With regard to the breeze which Mr. Bloor found in coke, it was common to almost all coke-handling plants. They came to the conclusion, after they had had their apparatus working for some time, that the increased quantity of breeze they were obtaining from the De Brouwer conveyor was largely due to the rotary screen; and looking at the plant which Mr. Bloor had put before them, it was seen that the screen was double the length for the quantity of coke which the conveyor was handling. They did away with the rotary screen altogether, because they thought this was the source of a large quantity of breeze being formed. They introduced bars, which took out the breeze just as effectively as the rotary screen did, and reduced the quantity of breeze formed. Another interesting point in connection with the conveying machinery was the slacking of the coke. A very difficult problem with all classes of coke-handling machinery was to get the coke properly quenched without making it too wet. They might have erred on the side of getting it too dry; and the result had been that on several occasions they had had fires in the coke-hoppers. The method adopted, of putting sprays into the coke as it passed along, was the right one; but a certain amount of water was lost in the overflow system which Mr. Bloor had at the end of the house. If they got the water into the conveyor and allowed it to tumble back, as it did, over the coke, they got a very efficient quencher. He was interested in the electric scheme for moving the coke from the retort-house either to the wagons or the heaps. Could Mr. Bloor give them some information regarding the cost of this installation, and the cost of working it? It was, so far as he knew, a novelty in coke-handling plant. It seemed to work exceptionally well, and appeared very simple and apparently an excellent method of handling coke.

Mr. A. C. Hovey (Sheffield) said Mr. Bloor had mentioned difficulties with which he had had to contend, and had put forward details which he thought were essential to success. With regard to the stopped pipes, it would seem that the demolition was brought about not merely because of the effect of the stopped pipes, but because the plant itself was in a considerable condition of disrepair, and so he decided to make a clean sweep. With regard to the shoot for the back falling, he considered this a carefully thought-out design. As to the spray with the gland cock, that was an arrangement with which he had to deal about fifteen years ago, and which was in actual use at the present time. But instead of having a single spray there was a double or single spray. With regard to driving the breaker with a belt, in that case the same object could be achieved by a fuse in connection with the motor. To throw off a belt was not a very nice operation, and to work with a slack belt was not economical. The auger which Mr. Bloor produced reminded one of the old halberdiers.

Mr. S. Shadbolt (South Bank) remarked that there was certainly no golden rule which could be applied universally to the stopped pipe trouble. In the past twelve months he had experienced very little trouble.

Mr. Bloor, replying to the discussion, said he had tried to tell them what had been done in the most simple and straightforward way. One had had cause to think that, in connection with descriptions such as he had given, they were not always as candid as they ought to be. He had made a pretty exhaustive study of stopped pipes. One or two of their coals were particularly likely to cause stopped pipes. Two of them, while quite satisfactory for gas making—but which, by the way, made bad coke—were fruitful sources of stopped pipes. The auger had been referred to as a weapon; but it only weighed 5 lbs., and the stokers had no difficulty in using it. It was the bottom foot of a stopped pipe that caused the trouble. He had travelled a good way to get enlightenment on stopped pipes. He had met half-a-dozen men who had had serious trouble with stopped pipes; but afterwards the trouble ceased, and not one of them could say why they no longer had

stopped pipes. "It simply went away," they said. He resolved that he would not give an answer to the problem in any such unscientific way. They had certainly made the stopped pipe trouble less difficult. Now they had kept it within due limits, and were doing so by the aid of the auger. Regarding the cost of the coke-gantry, Mr. Bloor gave some figures to the meeting, but said he did not wish them recorded, as he was speaking from memory, and they might not be absolutely correct.

INSTITUTION OF GAS ENGINEERS.

Visit of the Council and Joint Refractory Materials Committee to the Central School of Science and Technology, Stoke-on-Trent.

In connection with the meeting of the Council of the Institution of Gas Engineers at Stoke-on-Trent, a visit was paid the previous afternoon to the Central School of Science and Technology. Dr. Mellor, the Principal, received the visitors, included among whom were Mr. A. E. Broadberry, the President of the Institution, Mr. Samuel Glover, Vice-President, Mr. W. E. Price, Hon. Secretary, and the Secretary, Mr. W. T. Dunn (who has quite recovered from his indisposition). The Joint Refractory Materials Committee of the Institution and the Society of British Gas Industries was represented by the above and by Dr. Harold G. Colman, Chairman of the Committee, the Hon. Secretary of the Committee, Mr. J. P. Leather, Mr. Alfred Cliff, Professor Cobb, and others.

The principal object of the visit was to enable the Council and the Committee to inspect the apparatus which has been set up for the investigation referred to by Dr. Colman at last year's meeting of the Institution. Mr. Audley and Mr. Emery have both been engaged on this work, under the supervision of Dr. Mellor. At the Institution meeting next month, a report of the work will be presented. A number of bricks have been obtained from various makers, and careful measurements of their hot to cold condition taken by the Coppée method. The question of after-contraction of fire-bricks has also been gone into, with the object of proving the test set forth in the Committee's well-known specification. One could not help recalling the paper given by Mr. F. J. Bywater at the meeting of the Institution in 1908, read at the Shepherd's Bush Exhibition on the last day of the meeting. This communication really formed the origin of the work which has now become of such national importance. To the Institution of Gas Engineers for undertaking and continuing the work credit is due; and in any larger scheme to embrace all industries concerned with refractory materials, it should not be forgotten.

Fortunately for the visitors, Mr. Bernard Moore, who has been appointed by the State Advisory Committee of the Privy Council for Scientific and Industrial Research to carry out experiments on a new furnace for firing porcelain goods, was proceeding with a sixteen-hour test of the furnace, which is designed on practical lines, and was actually firing a number of cream-jugs. Being heated by town gas, it naturally attracted close attention. Should it prove successful—and, so far, the results appear to be satisfactory—there will be a great saving in coal consumption in the Pottery district, and another important industrial application of coal gas will have been accomplished.

The manufacture of Seger cones—made of various compositions of fire-clay—for the determination of the temperature of furnaces, kilns, &c., is carried out in another part of the school premises. When the war broke out, Dr. Mellor at once saw the urgent necessity of producing these cones which are used in great numbers by steel makers, pottery manufacturers, and in a number of other industries. Hitherto they had been made only at the Royal Porcelain works at Charlottenburg. Dr. Mellor quickly succeeded in arriving at the correct system of manufacture; and so great is the demand for these cones that more than 30,000 a month are supplied. The manufacture is so simple in character that young boys, fresh from school, are employed in it.

As to the general work of the school, the visitors were informed that the building was rendered necessary by the largely increased number of students desiring to take advantage of the facilities offered for instruction in pottery and porcelain manufacture and in the principles of mining. Before the federation of the pottery towns in 1910, instruction in pottery and mining was under the control of the Education Committee of the County Council of Staffordshire. After federation, the responsibility for the classes devolved on the Education Committee of the Town and Borough of Stoke-on-Trent, who continued the work in co-operation with the County, and offered facilities, by a system of composite fees, to students who were wishful to take up co-related subjects. The total cost of the erection (exclusive of the site selected, which is valued at something like £6000) is about £24,000, and the School provides adequate accommodation for a complete course of instruction in pottery and mining, to which it is intended eventually to add provision for a course in engineering subjects. At present, students are engaged at their ordinary work during the day at the various manufactories throughout the district, and attend evening classes at the school. The "sandwich" system is, however, about to be introduced—so that they can be at the works in the early part of the day and attend the lectures at the school in the afternoon—the evening being thoughtfully left for recreation.

Mr. Broadberry expressed the thanks of the visitors for the interesting time they had spent at the school. The party then proceeded to the works of Messrs. Howson, at Bury Hill, where fire-clay goods of different kinds are produced. On the following morning, they visited the works of Messrs. Minton and those of Mr. Bernard Moore, the consultant potter to the firm.

PEAT AND WOOD IN GAS-MAKING.

Some provisional details of the inquiry which has been undertaken by the Société Technique du Gaz en France into the use of peat in gas making are reprinted in the current "Journal des Usines à Gaz" [May 5].

It is reported that, owing to shortage of labour, the peat deposits of the Somme can no longer be dealt with. The Society has been in consultation with the Government Committee entrusted with the duty of investigating the carbonization of fuels which do not yield coke. The Secretary of the Committee, Prof. Guillet, is obtaining and examining peat from the Loire-Inférieure and Haute-Saone; and results of its carbonization will be published at as early a date as possible. The great obstacle to the use of peat, however, is its high content (80 to 90 p.ct.) of water, rendering its transport costly, and calling for the further expense of drying, which removes only 20 to 30 p.ct. of moisture. It is pointed out that in Canada, Norway, and Italy, where peat is subjected to destructive distillation, the process is carried out on the spot, and for the production, moreover, not of gas, but of ammonia and cyanamide. The question is to be further studied by the Manufacture Committee of the Society; and M. Rouland, of the Paris Gas Company, promises experimental help—probably that of M. St. Claire Deville. The Committee are proposing to investigate the drying of peat, carbonization, lighting, calorific properties of the gas and quantity and character of the bye-products.

M. Bigeard at the same meeting stated that at Angers he had used fir (undeprived of its resin) which had been felled six or seven months, in quantity equal to from 1·5 to 1·8 p.ct. of the coal distilled. Carbonization occupied two hours, and yielded a gas which, on admixture with that from the coal, slightly reduced the density of the latter. Further experiments in the distillation of wood are promised from the Romorantin and Beaufort-en-Vallée (Maine et Loire) works. The question is evidently one which in present conditions is of interest to the smaller French gas-works.

USE OF GAS FOR GALVANIZING.

What is regarded as a somewhat unusual application of manufactured gas is described by Mr. W. J. Harris, jun., in the "Gas Record." It is to the heating of galvanizing baths, the few installations for which that have been previously tried having been unable to meet the competition of coke on a cost basis. The galvanizing bath is usually a rectangular steel tank; and because of the settling of the "dross," it is impossible to apply heat directly to the bottom. Therefore it is customary to place the tank on a brick or sand foundation, and to build a brick setting round it, with space for a coke-fire between the sides of the tank and the inside of the setting. In the gas installation described (which is in connection with a bath originally designed for a coke-fire), instead of a plain brick setting, there were provided cast-iron casings lined with brick—a very suitable arrangement for the installation of the standard "impact type" of surface combustion burners. A supply of gas at 4 lbs. per square inch pressure being available, the inspirators were specially designed to operate on 3 lbs. at the normal working rate; and a motor-driven gas-booster was installed (though ordinarily not needed) for use should a higher rate be desired, or the service pressure of the gas drop. The proportioning of gas and air is entirely automatic, without the employment of governors or any appliance with moving parts. Temperature is controlled by the simple adjustment of the gas-valve. The burners on all the four sides of the setting are connected to separate inspirators, which are in turn connected independently to the high-pressure line. The heat on each side of the bath can thus be regulated independently, or any set of burners turned off entirely, if desired. The capacity of the old coke-fired bath was 69,000 lbs. of zinc, while that of the gas-fired bath is 60,000 lbs. In the matter of steel coated per day the capacity, however, is the same; and the fuel consumption was figured on this basis. Coating 30 tons of steel sheets and melting 8000 lbs. of zinc, the coke used was found to be 4000 lbs. per day of 24 hours; and the entire time of a man was needed. This came to $15·80 per 24 hours. The gas installation was sold on a guarantee that, doing the same work, the consumption would not exceed 40,000 c.ft. of 600 B.Th.U. gas per 24 hours. At the prevailing rate, this came to $16·40. These figures are, however, based on normal conditions. Actual results have proved so satisfactory that the Surface Combustion Company, of Long Island City, will as soon as possible be changing over a second coke-bath.

The Sheffield Corporation have agreed to an application by the Board of Trade, Control of Mines Department, for the loan of the temporary services of Mr. W. M. Miles, their Analytical Chemist, to assist in the preparation of a coal re-distribution scheme now under consideration.

LUMEN-BASIS CALCULATIONS

For Lighting a Cathedral by Gas.

In connection with the lighting by means of a semi-indirect gas installation of the Cathedral of St. Peter and St. Paul in Philadelphia, information as to the preliminary calculations of illumination was, says the "Illuminating Engineer," given by Mr. J. D. Lee in the "Transactions of the American Illuminating Engineering Society."

It was assumed that with this form of lighting the utilization efficiency would be about 25 p.ct.—*i.e.*, that only 25 p ct. of the light derived from the lamps would be received on the working plane. The total lumens is, therefore, given by the formula:

$$\frac{\text{Illumination} \times \text{Floor Area}}{0{\cdot}25}$$

In this case an intensity of illumination of 1 foot-candle was considered sufficient; and the area to be lighted is approximately 150 ft. × 200 ft. The total lumens required are therefore:

$$\frac{150 \times 200 \times 1}{0{\cdot}25} = 104{,}000 \text{ lumens.}$$

The incandescent units of the type selected were previously found to give approximately 315 lumens per cubic foot. The consumption of gas required to light the floor area is thus equal to:

$$\frac{104{,}000}{315} = 318 \text{ c.ft. per hour approx.}$$

Each burner of the type decided upon consumes 2·75 c.ft. per hour; so that the number of mantles needed would be about:

$$\frac{318}{2{\cdot}75} = 115 \text{ approx.}$$

It was decided to use twelve appropriately spaced units; so that each unit would have, on the average, ten mantles. After various experiments, the final arrangement comprised twelve units—six with fifteen mantles and six with twelve mantles. The correct spacing would depend on the distribution of light from the units; and this was also worked out beforehand.

City of Santos Improvements Company.

At the annual general meeting of the Company last Wednesday, Mr. H. K. Heyland (Managing-Director), who presided, announced that Mr. D. M. Fox, feeling that at his age he was unable to give the time and attention to the business which it deserved, had resigned the position of Chairman of the Company. Out of the available balance, the Directors were able to recommend a dividend for the year of 3 p. ct. (less tax) on the ordinary share capital. As to capital expenditure, the erection of the new retort-house, comprising three sets of vertical retorts, each containing eight retorts, had absorbed during the year over £7000. One set would be ready for use this month. The coal-handling plant and coal-store had absorbed nearly £3000, and were now practically complete. The net revenue in Santos from the gas supply showed a decrease on the previous year of about £9400. This was due partly to a lower exchange, but mainly to high cost of coal, and its inferior quality. There had been a decrease of 153 in the number of consumers; but, on the other hand, the increased demand for cooking and heating all but counterbalanced the decrease in lighting. The quantity of gas sold for cooking and heating had increased in four years from 13,000,000 c.ft. per annum to 23,000,000 c.ft. The actual quantity of gas sold for all purposes was 8,,000,000 c.ft., as against 81,000,000 c.ft. for 1915. The Manager (Mr. Bernard Browne) had been for some time using a proportion of wood for producing gas, and had also been making experiments with Brazilian coal (which was of very inferior quality) and shale, the latter from the uplands of the State of Sao Paulo. Neither had hitherto proved very satisfactory. These facts indicated that Mr. Browne had been making every possible effort to produce gas from material other than gas coal. It was most unfortunate that the completion of the vertical retort installation had been delayed; otherwise he could have carbonized wood in the existing bench of retorts and used coal in the verticals, with very great advantage. Never had the Company been so ably and successfully managed as it had been by Mr. Browne since he took up his appointment just over five years ago. Mr. A. F. Phillips added some appreciative remarks on the subject of Mr. Fox's services to the Company.

Fatality at Nottingham Gas-Works.—A fatality occurred on Friday morning at the Basford works of the Nottingham Corporation; the victim being Benjamin Iveson (aged 69), who was struck upon the back by the door of a wagon falling upon him while he was effecting repairs. The injuries caused were such that he expired shortly after admission to hospital.

Manchester Gas Department War Benevolent Fund.—The statement of the Hon. Treasurer (Mr. T. Williams) of the Manchester Corporation Gas Department War Benevolent Fund for the year ended March 31 shows that good use has been made of the money received. Indeed, the payments made to dependants have proved very helpful after the termination of the "statutory" allowances by the Corporation. The subscriptions of employees in various departments for the twelve months amounted to £388. Allowances were made to dependants of six employees who have fallen in the war; and there were twelve special Christmas gifts. In addition, allowances were made to a man discharged from the army suffering from shell shock, and to another as a contribution to the cost of an artificial arm. The Chairman to the fund is Mr. Fredk. A. Price, and the Hon. Secretary Mr. G. W. Kaye.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Comparisons at Burnley.

Sir,—On p. 255 of your issue dated the 8th inst., the Chairman of the Burnley Gas Committee (Mr. Alderman Emmott) reiterates, in effect, his statement published in your issue of March 27 last—viz:

> "If Mr. Sutcliffe would take out the cost of gas-making pure and simple—the price for coal, wages, and all expenses in connection with manufacture—he would find Burnley was making gas as cheaply as Sheffield, Widnes, or any other works in the country."

The reiteration of this statement is somewhat perplexing, in the light of Mr. Leather's correction on the point in your issue of April 17.

If Mr. Alderman Emmott's claim is fair, a simple statement of the comparative figures of costs at Burnley and Widnes would surely put an end to the matter, and at the same time give Burnley the credit of occupying the position I myself have for the last quarter-of-a-century claimed for Widnes—namely, that of manufacturing gas at a less cost than any other works!

I have already, through the courtesy of Mr. Leather, been supplied with the figures of total net cost of manufacture of gas into holders at Burnley, for the year ending March, 1915 and for 1916; but, unfortunately, the details of the costs were not included.

In order that the position may be made clear, I give below the Widnes figures in detail for these two years, together with the Burnley totals, and would ask Mr. Alderman Emmott to publish the corresponding detailed figures for Burnley, together with such reservations as he may consider Burnley is properly entitled to claim in the comparison.

Isaac Carr.

Widnes Gas Works, May 10, 1917.

Net Cost of Manufacture of Gas in Holders.
In pence per 1000 c.ft. sold.

—	Widnes. 1915.	Burnley. 1915.	Widnes. 1 16.	Burnley. 1916.
Coals	11·932	..	14·499	..
Wages	1·050	..	1·199	..
Salaries	·200	..	·200	..
Purification	·188	..	·000	..
Retorts	·173	..	·217	..
Repairs to works and machinery	·736	..	·865	..
Yard labour	·301	..	·243	..
Sulphate plant and repairs	·636	..	·830	..
	15·216	..	18 053	..
Less revenue from residuals	10·718	..	13·161	..
Net cost of gas in holders	4·498	12 92	4·892	12·51

Priority for Gas-Works Plant.

Sir,—I trust you will allow me a little space in which to explain my reasons for proposing the resolution, at the Eastern Counties meeting, to which you referred in a leaderette in your last issue. There was not time at the meeting for a long speech explaining my meaning; and it appears that the proposal has, in consequence, been misunderstood.

The fact is I had heard from several sources that the difficulty was very acutely felt; and I was led to believe that it was in the interests of the industry that some united action should be taken, so that the Priority Department could be assisted to deal with the mass of applications which they no doubt receive.

Nothing was further from my thoughts than any criticism of the National Gas Council or the Priority Department. The former has already done valuable work for the industry; but I have completely misapprehended the reasons for the organization of this representative body, if it is not intended to receive and consider representations by the rank-and-file as organized in the District Associations.

If, after due consideration, the Council resolves that it is not desirable to adopt the course suggested, then I for one should not quarrel with its decision, nor attempt to press the matter further.

Possibly the wording of the resolution was not the best possible; but it could easily have been altered. The object was to call the attention of the National Gas Council to a matter which affects the industry very seriously, and to leave it to take whatever steps may be deemed advisable in the best interests of all concerned. I did not suggest that permits should be issued without individual inquiry into the need of each particular piece of apparatus.

Mr. Goodenough said "that when twelve things were wanted, and only six were available, neither the Ministry nor anyone else could make the goods go all round." Granted. And for that very reason if all the applications could be considered by the National Gas Council, or by a committee of experts as I suggested, the six articles would be distributed among those most in need, and the other six undertakings would be advised as to the best means of carrying on (possibly by a loan of plant from other works).

I quite agree that the Priority Department is sympathetic, and anxious to deal fairly with all the applications which come before it. The difficulty arises in showing (by means of lengthy correspondence) the need for certain materials to a Government department unacquainted with the needs of the industry.

Nor is it a question of the gas industry asking for a *quid pro quo* because of the important work it is doing. We do not ask for coal, or labour, in this spirit; and *necessary* plant stands on the same footing. Coal is of no use if one cannot convey it from the station, or put it into the retorts; and we should not ask for plant because it may save money

and avoid inconvenience, but because without it we cannot continue the work we are doing.

The matter of coal has been dealt with, and so has the question of labour, on which I think the National Gas Council has done most valuable work on behalf of the industry. There remains, in my view, the question of materials and plant; and as this had not received public attention, I brought it forward for discussion in the hope that some good might result.

W. W. TOWNSEND.

Colchester Gas Company, May 12, 1917.

Sliding-Scale Gas Companies.

SIR,—It is evident from Mr. Tagg's letter in your last issue that the injustice of the sliding-scale at present is leavening the gas industry a little; and collective action may possibly be the result. It will, however, be necessary for someone to take the initiative; and doubtless the more important and influential the one who does so, the more successful he would be in gaining adherents.

Should collective action be taken, however, and be limited to an application to the Board of Trade for variation of the sliding-scale clauses during the war period only, there would be great danger of the permanent interests of the gas industry being sacrificed to the temporary ones, owing to the fact set forth in my previous letter, that the economic conditions that existed at the time of the institution of the sliding-scale have been interfered with by legislative enactment to the prejudice of gas shareholders in sliding-scale companies. Hence I repeat that any action that may be taken should provide a permanent remedy.

It is not clear how this could be done except by promoting a Special Bill to modify the action of the sliding-scale, or even abolish it, as belonging to an economic era that is passing, if not already passed.

J. KELLY.

Bridlington Gas Company, May 10, 1917.

Blue Water Gas as a Diluent.

SIR,—I have taken your advice, and read the remarks of the President of the Institution of Gas Engineers, and Mr. Thomas Glover at the meeting of the Eastern Counties Gas Managers' Association, and see no reason whatever to alter my protest in any way.

It does not follow, at times like these, because one gas engineer (or any other member) at any (or many) other places can distribute 25 p.ct. of uncarburetted water gas, that others who are differently situated geographically or in other ways can do the same. It is probable that at works commanding ample supplies of the very best gas coal, such gas might be economically made. Whether advisable to distribute it or not must depend on local conditions in each case.

In many other towns, the quality of the coal obtainable and the condition of the distribution system and of the appliances employed for trade and domestic use would preclude the distribution of such a quality gas. Further, considering its lessened efficiency—more especially when used in apparatus to which it is not suited—there is little probability that ultimate economy would result in these places.

A. EDWARDS.

Taunton, May 10, 1917.

[The point made by Mr. Edwards regarding the different qualities of coal supplies was included in the footnote to his letter last week. With respect to the last part of his letter, he and other engineers will probably be interested in further information, including an appeal from the Coal Controller, that is contained in our editorial columns to-day.—ED. "G.J."]

REGISTER OF PATENTS.

Burners for Lighting or Heating.—No. 100,442.

SVENSKA ARTIEBOLAGET GASACCUMULATOR, of Stockholm, Sweden.

No. 5734; April 19, 1916. Convention date, May 11, 1915.

This invention relates to searchlight apparatus, welding apparatus, cutting apparatus, or the like, in which a gas mixture—say, a mixture of oxygen and a gas rich in carbon, such as acetylene—is used for establishing a flame for lighting or heating purposes. The burner is fed with the mixture through separate pressure regulators in such a way that the pressure in one of the regulators determines the pressure of the gas governed by the other regulator. The diaphragm of the latter regulator is influenced on its one side only by the pressure in the first regulator, and on its other side only by the pressure of the gas the pressure of which is governed by the latter regulator. Valves or cutting-off devices are inserted in the conduits leading to the burner at points between the burner and the pressure governors.

Lamp Globes.—No. 105,284.

KEITH, J. & G., of Farringdon Avenue, E.C.

No. 8441; June 15, 1916.

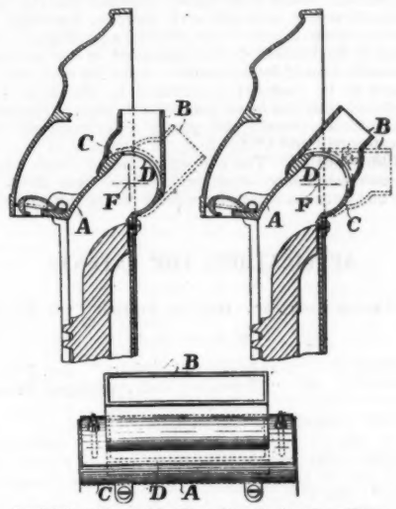
This invention provides, in substitution for the usual integral glass globes (which in the case of large globes in particular are liable to breakage due to the setting-up of internal strains), built-up or assembled globes constituted by glazed frames. The framework comprises a pair of coaxially disposed rings, produced by spinning, and the adjacent ends of which are bevelled outwardly and formed with wired beads—one ring, which constitutes the lower ring of the assembled globe, being formed with an inwardly directed flange. Connecting the rings are astragals—say, four in number. As the temperature conditions preclude the attachment of the astragals by solder, they are rigidly locked to the rings in such a way as to cause the minimum weakening of the rings and of the ends of the astragals consistent with a rigid joint. A glass bowl is dropped into the lower ring, resting on the inwardly directed flange, and being held in position by clips; while side panes fitted between the astragals are retained in position by engagement of the lower edge of each pane between the rim of the bowl and the lower ring, and the engagement of the upper edge of each pane by a clip or clips secured to the upper ring.

Adjustable Flue Nozzle for Gas-Fires.—No. 105,304.

LARKIN, F. S., of Fulham, S.W.

No. 13,846; Sept. 29, 1916. No. 17,409; Dec. 4, 1916.

The inventor proposes to provide an adjustable flue which "can be turned through a large enough angle to suit all practical adjustments, and which will not in any of its positions restrict the opening in such a way as to offer undue obstruction to the passage of the products of combustion or reduce the capacity of the flue."



Larkin's Adjustable Flue Nozzle for Gas-Fires.

Sectional side elevations (reversed) illustrate the flue nozzle in its vertical position; while a partial rear elevation shows the nozzle in a position corresponding to the second side elevation.

The part A of the gas-fire to which the nozzle B is attached is curved at C with an aperture D in it through which the products of combustion pass. The nozzle is made with a flange having a suitable radius to fit the cylinder so that the former can be moved round and allow the nozzle to be fixed at any desired angle.

To obtain the full range of angular adjustment the nozzle and its cylindrical flanged portion are so shaped that the nozzle can be reversed as in the second side elevation if the movement required is greater than that shown in dotted lines in the first one. When reversed, it is possible to turn it from the full line position to the dotted line position, when it is horizontal; so that its range of adaptability is considerably enlarged. The axis F, about which it pivots, is disposed to one side of the middle line of the adjustable portion B, so as to give a large and unobstructed outlet for the gases. The adjustable flue nozzle thus provided will not in any of its positions leave pockets for the gas to collect in, or serve to set up eddy currents in, and so obstruct the free passage of the gases.

Indicating the Rise and Fall of Gasholders and their Contents.—No. 105,366.

BOURNE, L. V., of Leicester.

No. 4983; April 5, 1916.

This apparatus is designed more especially for indicating the height, rise and fall, and cubical contents of gasholders, but it is also suitable for use in connection with tanks or other containers for indicating the rise and fall of the level of liquids and (if necessary) their cubical contents.

The apparatus, which may be placed almost any distance from the holder with which it is employed, comprises a device actuated by, or in timed relation with, the rising and falling body, adapted to transmit, at intervals corresponding to definite distance of rise and fall, an electrical impulse to an indicator to actuate the latter with a step-by-step movement, so as to show the rise and fall of the holder.

A feature of both the means for sending out the electrical impulses and the indicator actuated thereby is that they will operate in both a forward and backward direction—*i.e.*, in the one to indicate rise and in the other to indicate the fall of the holder—by means of a contact device combined with an actuator operated by or from the holder.

The preferred arrangement for closing the electrical circuit at intervals comprises a rotary drum upon which is wound a rope or equivalent, one end of which is secured to the drum and the other end to an arm or other fitment on the top of the holder or (in the case of a tank) to a float. The drum may have a smaller subsidiary drum on each side of it combined with which are a rope and weight adapted to impart rotation to the main drum to wind the rope when the holder descends or the float rises. The rise of the holder or fall of the float unwinds the rope and rotates the drum in the opposite direction, and so the drum rotates in one direction or the other in correspondence with the rise and fall of the holder or float.

The scope of the invention, and the means by which this appliance

works, are detailed in a lengthy specification of nine printed pages with five sheets of lettered drawings. Ten separate claims are made for the arrangement described.

Stills for the Fractional Distillation of Volatile Liquids.—No. 105,395.

Sadler and Co., Ltd., of Middlesbrough, and Bellerby, J., of North Ormesby.

No. 5306; April 11, 1916.

This invention relates to apparatus of the type wherein the liquid to be distilled is passed through a preheater and thence into a still proper, where it is partially vaporized, the vapour passing into the preheater for the purpose of heating the incoming liquid, and the residue in the still being conveyed to another heating chamber where further evaporation takes place. This invention has for its object to provide a process of evaporation which is primarily intended for the separation of crude benzol of varying strength with uniform fractions—viz., crude 90 p.ct. benzol, crude toluol, crude solvent, and stripped creosote.

The benzol to be distilled is first conveyed to the preheater, where it is preliminarily heated by the vapours from the main unit, into which it then passes to be partially evaporated by the heat derived from steam introduced into the lower part of the unit. The major part of the steam condenses therein and passes away with the unvaporized residue into the stripping unit, which, in the case of benzol, contains creosote suitably heated. The condensed steam which enters with the residue is reconverted into steam, and escapes from the stripping unit with all the constituents which have been left in the partially denuded liquid.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for May 9.]

Nos. 6052—6450.

Barraclough, A.—"Gas ovens and cookers." No. 6061.

Besson et Cie., H.—"Measuring and registering flow of fluids." No. 6169.

Coles, S. O. Cowper.—"Gas-radiator." No. 6408.

Dowson & Mason Gas Plant Company.—"Water-cooled tubes of gas-fired shell-billet, &c., heating furnaces." No. 6350.

Dowson & Mason Gas Plant Company.—"Gas-heated annealing, &c., furnaces." No. 6351.

Dowson & Mason Gas Plant Company.—"Air or gas reversing, &c., butterfly valves." No. 6352.

Dowson & Mason Gas Plant Company.—"Doors of gas-heated annealing, &c., furnaces." No. 6353.

Gallon, J.—"Distilling and condensing apparatus for gases." No. 6281.

Jack, F. B.—"Compressors, exhausters, &c." No. 6431.

Keith, G. & J.—"Controlling supply of combustible mixture to internal-combustion engines." No. 6392.

Major, J. L.—"Cooling, solidification, and delivery of pitch." No. 6314.

Mawby, E. W.—See Dowson & Mason Gas Plant Company. Nos. 6350-1-2-3.

Prioleau, W. L. St. J.—See Gallon. No. 6281.

Stuart, F. L.—"Raising and conveying coal, &c." No. 6244.

Tiernan, M. F.—"Indicating and measuring flow of gases." No. 6173.

Turner, C. E. G.—"Doors of fixed overhead bunkers for charging coal, &c., into travelling hoppers, and means for operating said doors." No. 6359.

Wallace, C. F.—See Tiernan. No. 6173.

Whatmough, W. A.—See Keith. No. 6392.

Worthington Pump Company.—See Jack. No. 6431.

Wright, T.—See Dowson & Mason Gas Plant Company. Nos. 6350-1-2-3.

Restoration of Lapsed Patent.

Notice is given that an order was made on May 4 restoring the Letters Patent granted to Thomas Thorp, Franklin Thorp, and Harvey Thomas Thorp, for "Improvements in and relating to indicating mechanism applicable to meters," No. 25,008 of 1911, dated Nov. 10, 1911.

Reduced Price at Uddingston.—The Directors of the Bothwell and Uddingston Gas Company, Ltd., have decided to reduce the price of gas to 2s. per 1000 c.ft., as from the 1st inst. The former price was 2s. 6d.

Monte Video Gas Company, Limited.—The Directors will report at to-morrow's meeting of the Company that the profit on the working of the year ended Dec. 31, as shown by the revenue account, is £26,672, and after providing for interest on debenture stock, and other charges, and including £13,261 brought forward from the previous year, the balance at the credit of profit and loss available for dividend is £30,951. An interim dividend of 6s. per share (less income-tax) was paid in respect of the half year ended June 30; and the Board now recommend the payment of a further amount of 6s. per share (also less income-tax), making together a dividend of 3 p.ct. for the year, carrying forward a balance of £14,694. The balance at the credit of the reserve account remains at £32,000, the contingency account at £17,739, and the insurance fund at £12,500. There has been a satisfactory reduction in the cost of carbonizing, consequent upon the provision of the new retort-house. Great difficulty has been experienced in shipping coal and materials to Monte Video; and the cost of freightage, coal, and materials is now higher than at any previous time since the outbreak of war. Owing to the continued commercial depression, there has been general economy in the consumption of gas; the sales showing a decrease compared with the previous year of 10·29 p.ct.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

The Kenilworth Gas Bill was read the third time, passed, and sent to the Commons.

HOUSE OF COMMONS.

Progress of Bills.

The Kenilworth Gas Bill was read the first time, and referred to the Examiners.

The Standing Orders were reported to have been complied with in the cases of the Haslemere and District Gas Bill, the Hemel Hempsted Gas Bill, and the Lea Bridge District Gas Bill, which were ordered to be read a second time.

The South Staffordshire Mond Gas Bill was before the Unopposed Bills Committee, and was ordered to be reported for third reading.

The Sheffield United Gas Light Company's Bill was reported, with amendments.

"Jena" Glass.

Brigadier-General Croft asked whether the description "Jena" had always referred in the glass trade to glass coming from the town of that name, and whether he was aware that firms who have been required to quote for such glass have been under the impression that specifications for "Jena" glass only applied to glass manufactured in that town, and not to any imitation.

Sir A. Mond (the First Commissioner of Works) replied that the description "Jena" undoubtedly formerly referred to glass coming from the town of that name; but since the outbreak of war the term had been generally recognized by firms who had been asked to quote for such glass as defining a glass possessing special heat-resisting qualities. In fact, three out of the five tendering firms, including one of the successful tenderers, struck the word "Jena" out of the specification. Having regard to the fact that the importation of the products of enemy countries had been prohibited by the Government, it was inconceivable that, after nearly three years of war, any firm could have been under the impression that enemy-made glass was required.

Brigadier-General Croft: Does that necessarily apply to cases where glass might have been imported from some neutral country?

Sir A. Mond: It does not necessarily apply.

Brigadier-General Croft asked the name of the firm who received the order for "Jena" glass for which the Board of Works called for tenders.

Sir A. Mond said the names of the firms were Messrs. Falk, Stadelmann, & Co., of Farringdon Road, and Messrs. George Hands & Co., also of Farringdon Road.

Manufacture and Importation of Gas-Burners.

Brigadier-General Croft asked whether, in regard to upright and inverted gas-burners, provision was made by the Board of Trade to see that British manufacturers were provided with the necessary tube and sheet metal, whether for this purpose the Class A Ministry of Munitions certificates were granted to manufacturers, and whether the Ministry of Munitions had ignored many requests to provide the certificates for this production.

Mr. Kellaway (Parliamentary Secretary to the Ministry of Munitions) replied that, owing to the shortage for war requirements of sheet metal and of copper and its alloy brass, it was not possible for the Ministry of Munitions to grant permits for supplying manufacturers for the purpose referred to in the question.

Brigadier-General Croft asked whether the Board of Trade Import Department had granted a general licence for the import of upright and inverted gas-burners from the United States.

Mr. G. Roberts: The general licence referred to is being withdrawn as from May 15.

State Control of Coal.

Mr. Duncan Miller asked whether the financial arrangements had yet been completed by the Coal Controller in connection with the State control and management of the coal industry; and if he could say now what terms had been settled with the coalowners.

Mr. Roberts said the financial arrangements in connection with the control of coal mines had not yet been completed.

SHEFFIELD GAS BILL.

When the House of Commons Committee presided over by Mr. Mooney met last Wednesday morning to consider the contentious matters arising on clauses in this Bill, the preamble of which was found proved last week [see "Journal," p. 243], it was announced that the Sheffield Corporation did not intend to put in an appearance; the object being, of course, to reserve the Corporation right to oppose the Bill on preamble in the House of Lords.

The Parliamentary Agents announced that the Bill had been amended in accordance with the Committee's decision, and that, in addition, a clause had been inserted providing that if at the end of three years the land for the new gas-works had not been secured, the capital powers under the Bill would be automatically reduced by £1,000,000—this being the estimated cost of the new works.

The Bill was then ordered to be reported for third reading.

HEMEL HEMPSTED GAS BILL.

This Bill, which was sent forward last week by the Unopposed Bills Committee of the House of Lords for third reading, has, as already

intimated in the "JOURNAL," undergone considerable changes in detail since it was deposited.

The general objects of the Bill are to raise additional capital, and to extend the limits of supply. Under the original Bill, the sum of £30,000 was to be raised; but this has been reduced to £24,000, to be issued either as ordinary or preference stock or both—the total amount raised to include premiums. The borrowing powers are to be one-third of the existing capital of the Company, which amounts to £37,500. A calorific test of 500 B.Th.U. is included in the Bill, together with the usual powers as to the manufacture of residual products. A portion of the parish of Redbourn is added to the limits of supply. Special purposes and benefit funds may be established, and payments made to employees injured, and dependants of employees killed, in the war. Subscriptions may also be made to various funds; but the total on this account, and in respect of benefits to injured employees, must not exceed ½d. per 1000 c.ft. supplied during the year. The power to grant pensions is also limited to a like sum. The standard price is 4s. 2d. in Hemel Hempsted, within 1½ miles radius of the Church, 4s. 6d. in the remainder of the borough, and 4s. 10d. outside the borough, on the sliding-scale. This was not in the original Bill. Under clause 74, a profit-sharing scheme is authorized. Clauses have been added for the protection of the Corporation, the Hertfordshire County Council, the Midland Railway, and the London and North-Western Railway. Under the Corporation clause, the price to be charged for gas for public lighting is to be 20 p.ct. less than the lowest price charged to ordinary consumers.

KENILWORTH GAS BILL.

The Unopposed Bills Committee of the House of Lords sent this Bill forward for third reading last week.

The Kenilworth Gas Light and Coke Company were incorporated as a limited liability Company in 1856, with a capital of £3000, which has since been increased to £25,000, in addition to debentures amounting to £1000. Under the present Bill, the limited Company is to be dissolved and re-incorporated as a statutory undertaking with a capital of £50,000, including the existing capital of £25,000—*i.e.*, the Company have powers to raise additional capital amounting to £25,000, including premiums. This new capital may be issued either as ordinary or preference shares or both, and redeemable preference shares or debenture stock may be issued—redemption being out of capital. The original capital is 5 p.ct., and the new capital 7 p.ct. if issued as ordinary capital or 6 p.ct. if issued as preference. The borrowing powers of one-third include the £1000 already borrowed. Seven days' notice is to be given to the Warwickshire County Council as to the breaking-up of streets, instead of the three days provided by the Gas-Works Clauses Act; and in the case of the London and North-Western Railway Company's bridges or lines, the Engineer of the Company is to approve plans within 21 days. The maximum price for gas within Kenilworth is to be 4s. 6d., and 1s. extra for the districts beyond, which lie within the area of supply. The Company are authorized to vary the price according to the purpose for which gas is used; but there is to be no preference as between consumers using gas for the same purpose under like circumstances. A calorific power test of 500 B.Th.U. is provided for, with the usual penalties; the pressure being 15-10ths, except to the London and North-Western Railway Company, to whom the gas is to be supplied under a pressure of 20-10ths. Power is given to the Board of Trade to vary the calorific standard at the end of five years on application by parties entitled to be heard, as laid down by the Bill. Among other powers in the Bill are clauses relating to superannuation allowances, subscriptions to hospitals, the issue of stock under co-partnership rules, and the establishment of a benefit fund for the purpose of grants to employees, such fund not to exceed ½d. per 1000 c.ft. of gas supplied during each half year—the total amount not to exceed a five years accumulation. Clause 99 binds the Company not to oppose, except on details, a Bill by the Kenilworth Urban District Council, if introduced in the next session of Parliament, for the purchase of the undertaking.

Hyde Gas Company's Satisfactory Report.

The annual meeting of the Company was held on the 1st inst., when Mr. G. F. Drinkwater, C.C. (the Chairman), who presided, said, in moving the adoption of the report and accounts, that he ventured to think, when allowance was made for the exceptional difficulties and circumstances under which the working of the Company had been carried on during the half year under review, the proprietors would consider the trading results quite satisfactory, as they enabled the full statutory dividends to be paid, with a carry-forward balance to the next half-year's account. The difficulties that had been encountered were the further curtailment of public and domestic lighting, the unprecedented troubles in transport, shortage of labour, higher wages, and the advanced prices of coal and other materials which entered into the manufacture and distribution of gas. Briefly speaking, there had been a reduced consumption owing to the restrictions in force; and the cost of production in repect of materials and labour had considerably increased. The report and accounts were unanimously adopted; and a vote of thanks was accorded to the Chairman, Directors, and staff for their services.

An Appeal at Colchester.—Among a series of military appeals at Colchester in connection with conscientious objectors, was one relating to a storekeeper at the gas-works, aged 39 and married, who had previously been given absolute exemption. It was agreed that he had a genuine objection; the Military Representative (Lieut. Payne) remarking that he should take up work of national importance. The respondent claimed that his present work was of national importance; and the Tribunal dismissed the military appeal. Lieut. Payne said he would refer the matter to the Appeal Tribunal.

LEGAL INTELLIGENCE.

REVOLUTION IN HEALING SCIENCE FROM COAL TAR.

German Patent and Medical Research Committee.

The most remarkable of all the recent discoveries of the use of coal tar came before the Patents Court last Friday, when four firms applied for licences to manufacture under a German patent yielding the most astonishing antiseptic for war surgery that has been forthcoming since Lister opened-up the beneficent field of antiseptic treatment. The applicant firms were Messrs. Blandy Bros. & Co., Messrs. Levenstein, Ltd., Messrs. May and Baker, Ltd., and Boots Drug Company. The patent is No. 24,652 of 1910, in the name of Messrs. Leopold Cassella & Co., Gesellschaft mit beschränkter Haftung, of Frankfort-on-Main, and is for "Improvements in the Manufacture of 3·6 Diamino-Acridine and its Derivatives." It is a German dye patent deriving from coal tar; but British science has lately discovered that, while it has been superseded in economical dyeing, it offers an antiseptic of unique properties.

A report on its new-found virtues was recently made to the Medical Research Committee by Dr. C. H. Browning, Dr. E. L. Kennaway, Dr. R. Gulbransen, and Dr. L. H. D. Thornton, of the Bland-Sutton Institute of Pathology, Middlesex Hospital, in which they say: "The substance belonging to the acridine group, 'Flavine' has been found to possess extremely powerful bactericidal and antiseptic properties, which are enhanced rather than diminished by admixture with serum. In this respect, Flavine differs from all the powerful antiseptics in common use." The report was followed in the "British Medical Journal" of Jan. 20 last by an article by Dr. D. Ligat, F.R.C.S., Acting Assistant Surgeon to the Middlesex Hospital, on "Flavine and Brilliant Green in the Treatment of Infected Wounds." The physiological characteristics of its rapid healing are described. Dr. Ligat gives striking instances of cures. "Other substances," he says, "are either highly irritating to the tisues, or they are rendered practically inert owing to an admixture with the secretion of the wound." Dr. Ligat says that he has treated a large number of shrapnel wounds, some 6 in. square, "with invariably successful results" with Flavine.

Mr. CARPMAEL, in presenting the application of Messrs. Blandy Bros., and Co., said it was highly gratifying that the honour of discovering this potent antiseptic fell to British doctors. Those at the Bland-Sutton Institute who made these historic experiments had requested Messrs. Blandy Bros. & Co. to manufacture the substance. The firm entered on the undertaking from the humanitarian point of view.

Mr. ELLIS, in submitting the application of Messrs. Levenstein, Ltd., stated that the German production was associated with the trade mark "Trypa-Flavin," which might give the Court some trouble in arranging a new name. He desired simply to urge that the trade mark should be voided. Its use would only create complications when Cassella's entered the commercial field again after the war. The Government authorities had asked Messrs. Levenstein to supply them with this substance, and Messrs. Levenstein had made the War Office a present of all they had manufactured. In their correspondence, they referred to it as "Wound antiseptic, Avvalin brand."

Mr. POTTS, who represented Messrs. May and Baker, Ltd., said the problem in antiseptics had been to find a substance which had a specific or selective action on the disease germs and, with a high toxic action on the parasite, had very little dangerous action on the body itself. The patent was first found to be useful for sleeping sickness. Flavine as manufactured was never likely to be a cheap substance, though its dilution brought down the cost. It would sell at several shillings an ounce; but a solution of one part in a thousand of water (as employed in the cases dealt with in Dr. Browning's report to the Medical Research Committee) yielded a sufficiently powerful and efficient antiseptic. Over 1500 cases had been treated in fifteen months; and in a case where a man had had a piece of skin torn from the scalp, the size of a man's hand, the wound was entirely healed in five days by the employment of this specific.

The CONTROLLER said he would consider the advisability of granting the licences without royalty, since the material was wanted for war work and was expensive; and the problem of the name by which it should be known would have to be examined. They might decide to consult the medical fraternity on what to call this product of coal tar; but the licences would certainly be issued, and the applicants might get on with its manufacture as soon as possible.

Omagh Gas Deficit.—At a meeting of the Omagh Urban Council, a report submitted by the Auditor showed that the gas undertaking had cost the town rate £1680 for the past year. It was stated that this large deficit was chiefly due to the increased cost of coal.

Rochdale Gas-Works Results.—It was stated at a meeting of the Rochdale Gas and Electricity Committee that the gas profit for the past twelve months was only £3741, against £15,099, or £11,358 less than a year ago. The total income was £113,376, a reduction of £7080. On the sale of residual products, there was a further falling off of over £1800. The working expenses amounted to £90,004, against £91,547, leaving a gross profit of £22,972, against £28,909 a year ago, or £5937 less. In the working expenses, £54,827 represents the outlay on coal, against £53,604 a year ago. But substantially less coal was purchased last year; and the price was, of course, much higher. Stokers' wages were £5116, against £5593. From the gross profit, there have to be deducted interest and sinking fund charges, half-wages to men on active service, and war bonus, amounting in the aggregate to £19,231, against £13,810, an advance of £5421. This leaves a net surplus of £3741. In accordance with a resolution of the Council, £6000 a year has to be put from profits to reserve or working capital fund. All this year's surplus goes to that purpose. Last year £1541 was allocated to rate relief.

MISCELLANEOUS NEWS.

GAS EXAMINATIONS QUESTIONS.

In last week's "JOURNAL" [p. 250], there were given the questions put to candidates in the recent examinations in "Gas Engineering," held under the auspices of the City and Guilds of London Institute; and now it is possible to supplement these by the questions set for the examinations on "Gas Supply" and "Gas-Fitting." The maximum number of marks obtainable is appended in each case.

GAS SUPPLY.

The examination was held on Saturday, the 5th inst.; the Examiner being Mr. Walter Hole, of Leeds. Not more than eight questions were to be attempted in the four hours allowed.

GRADE I.

1. If in busy thoroughfares you had the option of laying (say) 1000 yards of 8 in. high-pressure steel main with either run lead, lead wool, or welded joints, which would you adopt? State your reasons. [32 *marks.*]

2. Given two different samples of 1-inch brass main cocks, how would you decide which was the better of the two? [32.]

3. In working a gas-engine, what is the effect of (*a*) a leaky water joint to cylinder, (*b*) the furring of the water jacket, (*c*) fixing the water circulating tanks too low in relation to the engine, (*d*) improper timing of the exhaust-valve, (*e*) using too rich a mixture of gas, (*f*) over-oiling the engine? [34.]

4. State the principles underlying the construction of a dry gas-meter, and how precisely these principles are applied. [42.]

5. Fig. 1 shows a plan of the piping of a large room. At each point marked *a* a two-light pendant consuming 10 c.ft. per hour, and at each point marked *b* a bracket needing 5 c.ft. per hour, is taken off. State what size of rising main you would need for the whole supply.

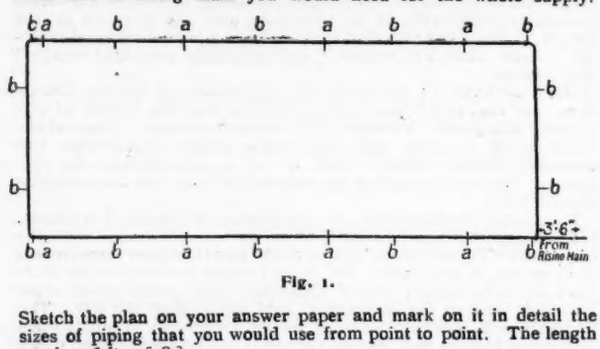


Fig. 1.

Sketch the plan on your answer paper and mark on it in detail the sizes of piping that you would use from point to point. The length *a* to *b* = 6 ft. [38.]

6. What is a regenerative gas-burner? Make a rough sketch of one in sectional elevation. [42.]

7. What different constructional details are introduced into a wind-proof lantern as compared with one which is not windproof? Illustrate your answer with rough sketches. [38.]

8. It is found that at a certain point 50 ft. distant from a source of light an illumination of 0·5 foot-candle is obtained. What illumination would you expect to receive from the same light-source at half that distance along the same line? Show how you arrive at your answer. [36.]

9. Describe any instrument used for the detection of gas leakage, and exactly how you would use it. [32.]

10. Fig. 2 shows a section through an automatic valve fixed to a

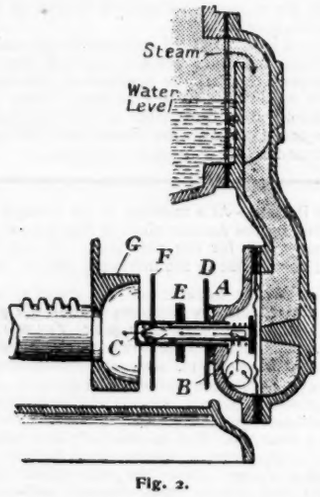


Fig. 2.

radiator. State precisely how it works, using the letters shown in writing your answer. [38.]

FINAL EXAMINATION.

1. Calculate the discharge from a perfectly straight and level main of 10 in. internal diameter, and 1000 yards in length, when the initial pressure is 3·5 in. and the final pressure 3·2 in. By how much would the initial pressure have to be increased to maintain the same discharge at the same final pressure, assuming that five ¼ bends whose radius = 2½ times the diameter and one right-angled tee were inserted at equal distances apart throughout the length? (Dr. Pole's formula = $Q = 1350d^2\sqrt{\frac{p\,d}{s\,l}}$. Sp. gr. = 0·4. Cripps's formula for bends $\frac{Q}{20d^2}$ = Velocity and $\frac{V^2}{10700} = p$. The back-pressure thrown by one right-angled tee may be assumed to be twenty times that of a bend of the radius given.) [38 *marks.*]

2. What particular dangers have to be provided against in the construction of high-pressure gas-meters, and how is the provision made? [32.]

3. It is required to ascertain the actual illumination afforded over the area of a thoroughfare lighted by an installation of high-pressure lamps. What apparatus would you require? State step by step how you would proceed to make the necessary tests. [42.]

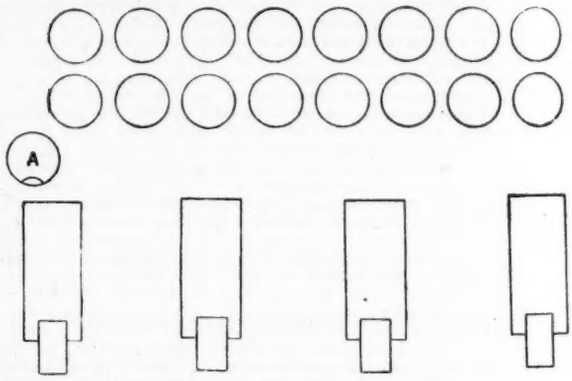
4. What exactly is meant by the term "mean lower hemispherical candle power"? Why is it necessary to supplement this with a polar curve in order to appraise the value of a lamp for any special purpose? Draw two approximate curves to illustrate your answer. [36.]

5. Discuss the latest developments in methods of testing gas-fires for radiant efficiency. [34.]

6. For what purposes, and within what range of temperatures, would you expect to obtain economical and efficient results from (*a*) natural-draught gas-heated furnaces, (*b*) air-blast gas-heated furnaces, (*c*) high-pressure gas-heated furnaces? When suitably used, what advantages has gaseous over solid fuel? [32.]

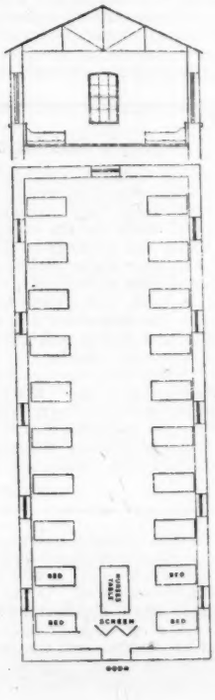
7. What are the principles underlying the ventilation of rooms by means of gas? Sketch any burner and accessories you consider suitable for the purpose. [34.]

8. Fig. 1 (on attached plate) shows in plan four gas-engines and sixteen water-cooling tanks; the latter being fixed on a concrete platform



in the open air. Show by lines how you would connect up—by arrows the direction of flow, and by letters where you would insert any necessary cocks or valves. Also draw the sleeve as shown at A in the correct position in each tank, and show where you would introduce your cold water. [38.]

9. Fig. 2 (on attached plate) shows a rough plan and elevation of a ward of a military hospital. How would you light it with gas, having



due regard to the comfort and convenience of patients and nurses? State type and position of burner or burners suggested, and any other point you consider of importance in your scheme. (The beds are 6 ft. 6 in. by 3 ft., and there is a space of 4 ft. 6 in. between each bed. The full width of the building is 27 ft. [38]

10. What would be the approximate effect on the intensity and direction in the illumination received from an inverted incandescent low-pressure burner consuming 3 5 c.ft. of gas per hour under the following conditions:

(*a*) When enclosed in a clear glass globe,
(*b*) " " " half opal globe,
(*c*) " " " half frosted globe,

as compared with the same burner used without glassware. Draw lighting curves on the squared paper provided to illustrate your answer. It is understood that the globes are of the ordinary plain spherical type, measuring 5 in. across. [42.]

GAS-FITTING.

The written examinations took place on Monday, April 30; and the practical ones, on Saturday, the 5th inst. The Examiners were Mr. H. Kendrick, of Stretford, and Mr. R. Halkett, of Glasgow.

Written Papers.

Three hours were allowed; and in each case candidates had to attempt Questions 1, 2, and 3, and not more than three others. It was intimated that if a candidate failed to satisfy the examiners in the obligatory questions, his other answers would not be considered. No certificates will be given to candidates on the results of Grade I. examination; but their successes will be notified. To sit for Grade II., candidates must have previously passed the examination in Grade I. Candidates for the Final must either hold a certificate in Grade II. or must have produced evidence of at least four years' training in the trade.

GRADE I.

1. Sketch an inverted burner with which you are familiar, and name each part. [50 *marks.*]

2. What size of pipe would you run to a cooker consuming 60 c.ft. of gas per hour? Would you recommend taking the supply direct from the meter, and the fixing of a flue-pipe? Give your reasons. Detail a list of the tools necessary when fixing a cooker. [60.]

3. Give a sketch of a 5-light dry meter, and name the various working parts. [55.]

4. Do you recommend the use of a governor on the outlet of a meter? State what, in your opinion, are the advantages and disadvantages of using a governor. [50.]

5. Under what circumstances would you use (*a*) a blown, (*b*) a screwed, and (*c*) a flanged joint? Describe the method of making each of these joints. [45.]

6. Describe a modern gas-cooker. Name each part, and its use. [45.]

7. What is the limit of the proportion of air to gas to complete combustion? Is more or less air required with straight coal gas than when mixed with water gas, and why. [40.]

8. What is composition pipe? Which would you prefer to use, iron barrel pipe or composition pipe? Give your reasons. [40.]

GRADE II.

1. A gas fire consuming 35 c.ft. per hour has to be fixed. The supply has to be taken from a ½-in. iron pipe under the floor. State step by step how you would do the work, the size of pipe you would run, and the fittings that would be necessary. [55 *marks*]

2. What is the difference between a geyser and a circulator? State the points to be observed in fitting each, and under what circumstances you would recommend their use respectively. [50.]

3. In a building four stories high, a meter is fixed on each floor. Suppose you have a complaint of no gas on the second and fourth floors, and are unable to obtain access to the third floor. State the probable cause of the defect, and the steps you would take to prevent any risk of accident. [45]

4. State what method and sketch the apparatus you would use in testing a new installation of gas-pipes for soundness, together with the pressure you consider necessary when no gas is procurable. [45.]

5. You have a complaint that an automatic steam radiator is not heating properly, and that the gas supply is not "shutting down." What would be the defects, and how would you remedy them. [50.]

6. How would you deal with a person who had been gassed? What precautions are necessary to guard against gassing when working with live gas-mains. [40.]

7. Describe minutely the operations to ensure accuracy of registration when watering meters. What precautions are necessary after watering to ensure that the supply of gas is in order? [45.]

8. What is the maximum length of piping you would instal, and what would be the maximum consumption in cubic feet per hour, for the following sizes of pipes, both in iron and lead: ⅜-in., ½-in., 1-in., 1¼-in.? [50.]

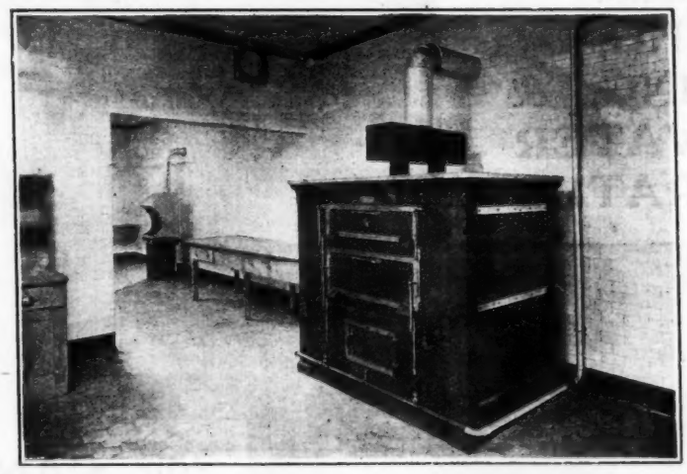
FINAL EXAMINATION.

1. State the principles of a gas-engine, and what defects are likely to arise. Give the points to be observed in the fixing of water-tanks, circulating pipes, gas and exhaust pipes for a gas-engine. [55 *marks.*]

2. Describe the working of the following systems of gas ignitions: (*a*) Pneumatic, (*b*) Telephos, (*c*) Norwich. Give a sketch of any of the systems. [50.]

3. A house with drawing, dining, and morning rooms, kitchen and scullery, four bedrooms, bathroom, and usual offices, is to be piped for gas lighting. Gas-fires are to be provided for in the drawing and dining rooms and two bedrooms, a gas-cooker in the scullery, and a circulator to the existing hot-water installation. State the size of service that would be required, also size of rising main, the size of pipe for supplies

FOR BREAD BAKING



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to the appliances, and each lighting-point, with approximate consumption. [60.]

4. Explain the difference between a gas steam radiator and a gas steamless radiator. Which do you prefer, and what are your reasons for your preference? [40.]

5. Describe the precautions necessary in the fixing and working of (*a*) a natural draught oven-furnace, (*b*) an air-blast furnace. [45.]

6. Give a description and the use of an inverted mantle, also of a "C" mantle. State the method of manufacture, and what material they are made of. [40.]

7. If a gas-engine, when working, causes an oscillation in the main, and affects the supplies in the locality, what is likely to be the cause, and how would you remedy it? [45.]

8. Supposing that, owing to non-payment of gas account, you have orders to cut off the supply of gas in a house, but on calling you are unable to obtain access to the premises, what steps would you take, and what would be the procedure before the supply was reconnected? [45.]

Practical Tests.

Candidates had to attempt all questions. For the practical tests in Grade II., candidates must have previously passed the examination in Grade I.; and candidates in the Final division must either hold a certificate in Grade II. or have produced evidence that they have had a training in the trade of at least four years. The instructions were that all inquiries must be addressed to the Local Examiner; and no books of reference were to be consulted, Candidates were not allowed to communicate with one another, nor to assist one another in the work they had to do. The time allowed is indicated in each case.

Grade II.

The following materials to be supplied to each candidate for Tests 1 and 3: (*a*) Two pieces of ¾-in. lead or compo. pipe, 12 in. and 18 in. long respectively; one ¾-in. cap and lining; sufficient supplies of solder and flux. (*b*) One 4-ft. length of ¾-in. iron barrel; three plugs for same; one equal tee and one backnut for same; one ¾-in. socket; one ¾-in. to ⅜-in. socket; one ⅜-in. brass tube cock.

1. Prepare and make a right-angled branch connection on ¾-in. lead or compo. pipe, and solder a ¾-in. cap and lining on one end of the upright portion. [1 *hour.*]

2. Examine a 1000 c.p. high-power low-pressure lamp. Explain to the examiner the use of each part. [20 *minutes.*]

3. Cut and screw two lengths of ¾-in. iron barrel pipe (one for running joint); connect to ¾-in. equal tee, and test same for soundness. [1 *hour.*]

4. Take to pieces a frame fire, removing brick and burner. Refit together, and leave it in proper working order. [¾ *hour.*]

5. Explain the working of a pressure-gauge. Name the different tools used by a gas-fitter, and the purpose for which each is used. [20 *minutes.*]

6. Fix and adjust various kinds of burners on a gas-rail. [½ *hour.*]

A *viva voce* examination on other matters connected with gas-fitting will be conducted during the work described above.

Final Examination

The following materials to be supplied to each candidate for Tests 1 and 6: One piece of 1¼-in. lead or compo. pipe, 2 ft. 6 in. long; one 1¼-in. cap and lining; one ¾-in. cap and lining; one piece ⅜-in. lead or compo. pipe, 5 ft. long; one piece ½-in. brass or copper pipe, 12 in. long; one ½-in. brass control cock with cap and lining on one end and female brass thread at the other end; three pieces ¾-in. iron barrel pipe, 18 in. long, screwed both ends; one piece ¾-in. iron barrel pipe, 6 in. long, screwed both ends; one ¾-in. connecting piece, 12 in. long; four ¾-in. bends; sufficient supplies of solder, white lead, and flux.

1. Bend the 1¼-in. lead pipe, and join up two unions as shown in fig. 1. [1 *hour.*]

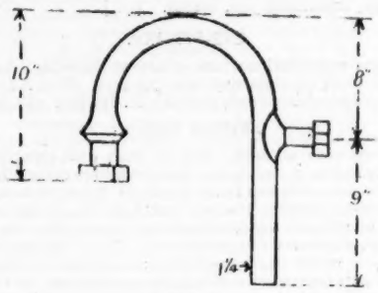

Fig. 1.

2. Inspect geyser, and explain the construction of same. Also state what precautions are necessary when fixing it to ensure satisfactory working. [¼ *hour.*]

3. Examine the sketch of a gas-heated hot-water installation. Give the defects (if any), and state how you would alter them to give satisfactory results. [¼ *hour.*]

4. Run supply and fix gas-fire, including control cock and brass tube. Adjust the gas-fire, and leave it in proper working order. [1 *hour.*]

5. Remove from the gas steam radiator the automatic valve. Take it to pieces, and explain the parts and working. Refix same to radiator. [½ *hour.*]

6. Make a 2 ft. 6 in. square frame of ¾-in. iron barrel pipe, leaving all joints gas-tight. [½ *hour.*]

A *viva voce* examination on other subjects connected with gas-fitting will be conducted during the work described above.

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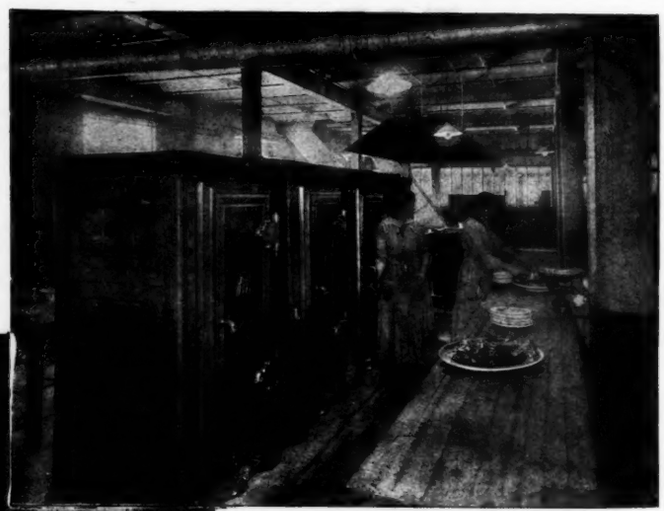

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NOTTINGHAM GAS PROFITS.

Nottingham Corporation gas profits have for years proved a never-failing aid to the relief of local burdens; but having regard to the continuance of abnormal conditions, no surprise might have been caused had the Committee found it necessary to announce a drastic diminution in the amount of this year's grant. Despite, however, the heavy handicap which has been involved, they were able to intimate to the Finance Committee, when the budget was in course of preparation a few days since, their intention to hand over on this occasion £30,000 towards meeting present unprecedented demands, or only £5000 less than last year.

How serious the condition might have become but for this continued aid, is shown by an examination of the figures relating to the city's general financial requirements; and the falling-off of contributions from collateral branches of municipal enterprise, &c. Consequent, also, upon heavy increased expenditure upon wages in all departments, entailing in bonuses extra payments to the extent of £53,000 annually since the outbreak of the war, the Finance Committee found themselves unable at their last meeting to do other than suggest that the district rate should be raised from 6s. 6d. to 7s. in the pound. Although there has been much grumbling in Nottingham as to the rigidity with which lighting restriction orders have been carried out, it is notable in the direction of economy to observe that £8000 has been saved upon the normal expenditure in this department. This, coupled with the advent of the Daylight Saving Act, accounts for the saving of an amount equal to a rate of more than 1¼d. in the pound.

In the ability to continue help at this critical juncture, the Gas Committee have been considerably aided by the extra 12½ p.ct. which was charged some time ago to meet the war conditions. It is unlikely, however, that the advance in price will be restricted to this margin; present indications pointing to a possible ultimate total increase amounting to 20 p.ct. Though stringent remedies are admittedly necessary in difficult cases, it may be urged that Nottingham gas consumers are being called upon to bear a disproportionate share of the municipal burden.

GAS-WORKS EXTENSIONS AT HALIFAX, CANADA.

An excellently written account of the construction of new additional gas and electricity plant at Halifax, including many interesting details, has been contributed to the "Gas Record" by Mr. W. E. Barrett, Consulting Engineer, of New York. The present addition is equal to a production of 750,000 c.ft. of gas per 24 hours; and space has been provided for future duplication of the condensing and scrubbing plant, and for erecting either a carburetted water gas plant, of 2 million c.ft. capacity, or for further coal-gas plant equal to one million c.ft., and for increasing the storage capacity by 750,000 c.ft.

The installation includes six furnace arches (four only to be filled at present), each arch containing six inclined slot retorts, 14 in. wide, 28 in. high, and 16 ft. long, with a producing capacity of each bed of 125,000 c.ft. per 24 hours; a reinforced coal pocket of 1400 tons capacity; standard condensing, washing, and scrubbing appliances; a set of three double-decked purifiers, each 15 ft. diameter and 12 ft. high; a 9 ft. diameter station meter; balance and automatic delivery governors; a two-lift holder, with steel tank, of 300,000 c.ft. capacity; also an ammonia still for concentrated liquor, and tar-stills for the recovery of light oils, heavy oils, and pitch. The new works included electricity plant, comprising generators, boilers, stoking machinery, a reinforced concrete coal-store to accommodate 1600 tons, conveying machinery that also served the coal-gas store, including a weight-meter that weighs the whole of the coal supply as discharged at the Company's wharf, and a repair shop for all kinds of gas, electric, and railway apparatus, with individually driven machines in place of shafts and belting.

GAS-ENGINE AND STEAM-TURBINE COMPARISONS.

The respective merits of gas-engines and steam-turbines as applied to modern iron and steel works practice were discussed at length by Mr. Douglas L. Cooper, of Middlesbrough, in a paper which he read before the Cleveland Institution of Engineers. In the course of his remarks he quoted figures, from which he said it would appear that, where coke-ovens and iron-works are attached to the steel works, the high first cost of the gas-engine installation is justified, even under existing war conditions. It might, and probably would, be argued that there was great difficulty in obtaining reliable gas-engines at the present time; but, considering the high efficiency of the modern internal combustion engine as compared with the steam-engine, was it not the duty of the British iron and steel manufacturers to encourage their engineers and assist them as far as they possibly could to turn out gas-engines in large quantities, and of design and efficiency equal to those made on the Continent and in the United States? The author expressed the opinion that this difficulty is gradually being overcome, and that gas-engines at present being built by makers in this country promise to hold their own with the best types ever yet constructed.

In opening, Mr. Cooper pointed out that the question as to which is the most economical method of converting waste gases into power for blowing the blast-furnaces and generating electricity, is one about which there is still much diversity of opinion. Some manufacturers favour turbo blowers and turbo electrical generators, and others gas blowing engines with either turbines or gas-engines for generating electricity. Perhaps, he proceeded, the most satisfactory way of making a comparison is to consider a modern iron and steel works, having four blast-furnaces each producing 1250 tons of pig-iron per week, or an aggregate of 5000 tons a week for the four furnaces. From generally accepted data, 150,000 c.ft. of gas, of a heat value of approximately 100 B.Th.U. per cubic foot, are evolved per ton of coke consumed in a

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blast-furnace; so that, assuming 22 cwt. of coke are required per ton of iron smelted, the total gas available from the above plant would be 825,000,000 c.ft. per week, of which (say) 38 p.ct. would be required for heating the hot blast stoves, including loss, leaving 511,500,000 c.ft. per week available for other purposes.

In conjunction with these furnaces, a coke-oven plant with a capacity for carbonizing (say) 8600 tons of coal per week would be required, which, based on a coke yield of 70 p.ct., exclusive of breeze, would give 6020 tons of coke per week (the consumption of the four furnaces, *plus* an excess of about 10 p.ct.); and since the modern coke-oven using Durham coal liberates at least 10,000 c.ft. of gas per ton of coal carbonized, with a heat value of (say) 480 B.Th.U. per cubic foot, of which about 50 p.ct. may be relied upon for outside uses, there would also be available from this source 43,000,000 c.ft. per week. The problem, therefore, which presents itself is how best to employ these resources so as to reduce to a minimum (or to render unnecessary) the provision of further fuel in the production of the finished steel. As blast-furnace gas is more suitable than coke-oven gas for internal combustion engines, it will be better to reserve the coke-oven gas for use in steel-smelting and reheating furnaces, either alone or mixed with blast-furnace gas.

The calculations which were then set forth in the paper were based on plant the cost of which at the present time Mr. Cooper estimated approximately as follows:

Steam-turbine installation—		
Six turbo alternators at £10,000 per unit		£60,000
Five turbo blowers at £8000 per unit		40,000
Foundations for six alternators at £1050 per unit		6,300
Foundations for five blowers at £850 per unit		4,250
		£110,550
A complete boiler plant, consisting of twelve units with necessary economizers, superheaters, two chimney-stacks, steam feed pipes, valves, foundations, coal and ash handling appliances, &c., would cost approximately £55,000, making a total cost for the steam turbine installation of		£165,550
Compared with this the cost of a gas-engine installation would be approximately:		
Six power units at £30,000 per unit	£180,000	
Five blowing units at £25,000 per unit	125,000	
Foundations for the six power units at £1500 per unit	9,000	
Foundations for the five blowing units at £1200 per unit	6,000	
Fine gas-cleaning plant	5,000	
Making a total cost of complete gas-engine installation		£325,000
Deducting from this total the cost of the complete turbine installation, there would be an extra cost for a gas-engine installation of		£159,450

—	Turbines.		Gas Engines.	
	Blast-Furnace Gas.	Coke-Oven Gas.	Blast-Furnace Gas.	Coke-Oven Gas.
	C.ft.	C.ft.	C.ft.	C.ft.
Blowing blast-furnaces	1,207,584	—	371,200	—
Power ,, ,,	320,584	—	119,571	—
Steel furnaces, heating	516,000	206,000	516,000	206,000
,, ,, power	158,136	—	58,981	—
Electric furnace	1,606,320	—	375,335	—
Rolling mills	1,689,180	—	630,027	—
Reheating furnaces and soaking pits	470,400	50,000	470,400	50,000
	5,368,204		2,541,514	
Available	3,044,642		3,044,642	
Deficiency	2,323,562	Surplus	503,128	

Thus, he said, there is in the case of a turbine installation a deficiency of 2,323,562 c.ft. of blast-furnace gas per hour—equivalent to 6465 kw.-hours in turbo-alternators—which has to be made good by burning coal under the boilers. At the present price of 18s. per ton, the cost of this would be £41,730 per annum. On the other hand, in the case of the gas-engine installation, there is a surplus of 503,128 c.ft. of blast-furnace gas per hour, which in gas-engines will equal 3753 kw.-hours. Calculating the value of this power for use or sale at £27,336 per annum shows a saving in favour of the gas-engine installation of £41,730, *plus* £27,336, or £69,066 a year. On the point of repairs, maintenance, and attendance, the figures quoted indicated a saving in connection with the turbine installation of £1164 per annum, giving a total net saving of £67,902 a year in favour of gas-engines, which is equivalent to a return of upwards of 40 p.ct. on the extra cost of installation involved.

During the discussion, Mr. Greville Jones declared that Mr. Cooper's opinion on the gas-engine question was not the opinion of men who had had practical experience. It was urged by Mr. Guy that, in view of the importance of the subject, the whole case should be investigated by a Committee; and this suggestion Colonel Hawdon (who presided) promised should be considered by the Council. Mr. James contended that, though there might be mistakes in the paper, he had yet to see anybody who could get away from the fact that they could secure as much power out of a cubic foot of gas if it was put into a gas-engine as if 2 c.ft. were used with blowers and steam. He quite agreed with Prof. Bone that the day was not far distant when a ton of steel would be put on the trucks with only the coal consumption necessary to smelt a ton of pig-iron; and he was further convinced that a gas installation was the only possible means of bringing this about.

By Appointment

CARRON

The Most Convincing Proof

of the excellence of

CARRON GAS COOKING APPARATUS

is the large number of MUNITION and other FACTORY KITCHENS equipped with these appliances. They enable the cook to cope successfully with the requirements of large numbers of workers where a quick and efficient service is absolutely essential.

Illustration represents COMBINED GAS GRILLER, TOASTER, and HOT CLOSET, having polished top and mouldings, mounted on cast-iron stand, with wrought shelf between legs, 1 ft. 11 in. deep by 5 ft. 6 ins. high, strongly-constructed in cast-iron, and most suitable for hard and continuous use. Griller has two compartments which will toast about 15 rounds under two minutes. Gas supply is reversible.

¶ **Plans and Estimates gratis. No. 5D illustrated and descriptive Catalogue post free on request.**

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Branch Works—**Phœnix Foundry, Sheffield.**

Showrooms: LONDON, LIVERPOOL, GLASGOW, EDINBURGH, BRISTOL, NEWCASTLE-ON-TYNE, and BIRMINGHAM

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 14.

Pitch is still being shipped to the near Continent, and the price is about 37s. net per ton f.o.b. makers' works. Ordinary London creosote is nominally quoted at 4¼d. net per gallon; but some is reported to have been sold recently for fuel purposes at more money. Solvent naphtha is somewhat dull; and although there is not much available, the value is easier again. Those products which are under Government control are unchanged in price.

The home agricultural trade is still requiring supplies of sulphate of ammonia on the basis of the price officially fixed.

Tar Products in the Provinces.

May 14.

There is nothing fresh to report concerning the markets for tar products.

The average values for gas-works products during the week were: Gas-works coal tar, 20s. 3d. to 24s. 3d. Pitch, East Coast, 16s. 6d. to 17s. 6d. per ton; West Coast—Manchester 15s. 6d. to 16s., Liverpool 16s. 6d. to 17s., Clyde 17s. to 18s. Benzol, 90 p.ct., North, 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 3½d. to 3⅝d. Heavy oils, in bulk, North, 3⅝d. to 4d. Carbolic acid, 60 p.ct., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 80s., bags included. Anthracene, "A" quality, 3d. per unit; "B" quality, 1½d. to 2d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *May* 12.

The situation remains unchanged. Export values are entirely nominal in consequence of the prohibition of shipments abroad; the prices fixed for home agricultural purposes still being £15 10s. per ton to mixers and distributors, and £16 direct to farmers, net cash, in makers' bags, carriage paid to destinations in Great Britain and Ireland.

Nitrate of Soda.

This market has continued very firm, and values on spot are well maintained at 25s. 6d. per cwt. for ordinary quality, and 26s. per cwt. for refined.

Manchester District Tar Prices.

The average price realized for tar, based on the value of the products for February deliveries in the Manchester district was 26s. 11d. per ton, and for March 26s. 9d.

COAL TRADE REPORT.

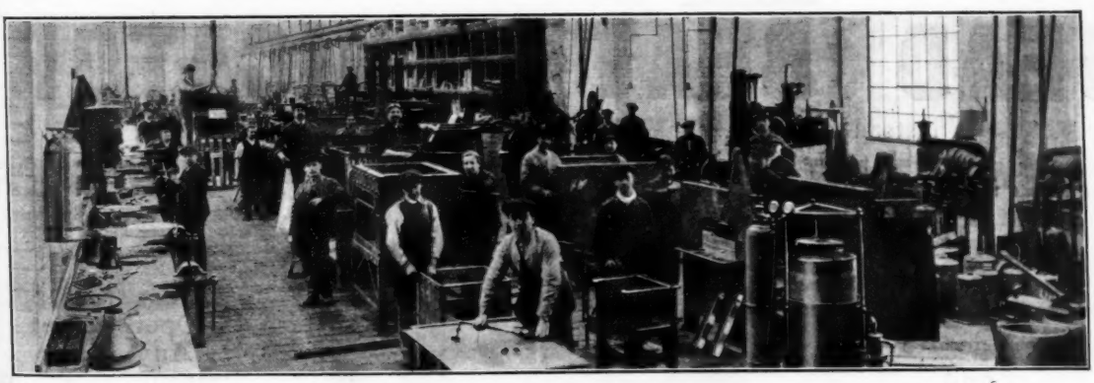
Northern Coal Trade.

The coal trade is more active, and with a little fuller supply of steamers the shipments are better, though still slow to foreign ports. But there is a larger quantity being sent than was the case a fortnight or so ago. Best Northumbrian steams are from 30s. per ton f.o.b.; second-class qualities are 22s. to 23s.; while for steam smalls the current quotation is from about 16s. to 19s. In the gas coal trade the output is well taken up, and the prices generally are firm. Best Durham gas coal is from about 25s. 6d. to 26s. per ton f.o.b.; for second-class gas descriptions the quotation is 18s. to 18s. 6d.; and for "Wear specials," the price is from 29s. to 30s. Gas coals are not as plentiful as usual at this season of the year. The full consumption locally of coking coal has its influence on gas coal and other Durham qualities, and helps to give fairly full work for the collieries, except those that depend chiefly on the export trade. Little is at present doing in settling new contracts for gas coal. The latest fixtures for gas coal freights shows that 20s. per ton has again been paid from the Tyne to London. In the coke trade, there is a brisk demand. For good gas coke 32s. 6d. per ton f.o.b. is quoted. The freights from the Tyne to the northern ports of France are still based on 45s. to 46s. to Dunkirk.

Price of Gas at Annan and Coupar Angus.—The price of gas is increased at Annan from 3s. 6d. to 4s. per 1000 c.ft. At Coupar Angus it has been been raised for lighting purposes to 7s. 6d., and for heating, cooking, &c., to 5s. 10d. per 1000 c.ft. for the first 5000 c.ft., and to 4s. 2d. for any further amount.

Fatal Scalding Accident at a Gas-Works.—An employee at the Beccles Gas-Works has died in hospital from injuries sustained while performing his duties. He was engaged in removing a joint in connection with a boiler at the works, when a rush of steam and hot water severely scalded him all over the body.

The National Research Syndicate has been registered with a capital of £50,000 in £1 shares, to conduct and utilize all kinds of experiments, processes, and manufactures, whether physical, chemical, or otherwise, &c. The subscribers (each with one share) are H. M. M'Gowan, Director of Nobel's Explosives Company; K. M. Chance, Managing-Director of the British Cyanides Company; and R. G. Perry, Chairman of Messrs. Chance and Hunt, of Oldbury. Nobel's Explosives Company may, while holding 11,000 shares, appoint two Directors; Chance and Hunt, while holding 11,000 shares, may appoint two Directors; and the British Cyanides Company, while holding 3000 shares, may appoint one Director. The last-named Company may, within three years, increase their shareholding to an equality with each of the other two Companies, and may thereupon appoint an additional Director.



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—Gas and Hard Fuel Furnaces are constructed for every process of heat treatment. Hundreds of Furnaces are being turned out to meet the increased engineering activity of the country. The absolute reliability of "Richmond" Furnaces, together with the certainty of securing accurate and constant results, have created a demand from Royal Arsenals, Government Controlled Factories, Naval Construction Works, Aeroplane Factories, the principal Engineering Firms, and from hundreds of Factories "converted" to War Work.

THE RICHMOND GAS STOVE & METER CO., Ltd.,

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Drogheda Gas Undertaking.

A statement submitted to the Drogheda Corporation by the Gas Committee, regarding the working of the undertaking during the year ended March 31, showed that there was not a sufficient balance of receipts over expenditure to cover the interest and repayment of loans. There had been a considerable reduction in the quantity of gas made, and the effects of curtailed public lighting, the Summer Time Act, and the change to Greenwich time were apparent in the accounts. Though the price per 1000 c.ft. was increased, the receipts were less than in the previous year. The coal price was £2000 in excess of pre-war prices. Other expenses were practically normal. Urgent repairs would now necessitate an increase of revenue; and the Committee recommended that the price of gas be increased 2d., to 4s. 6d. per 1000 c.ft., and the charge for coke to £2 per ton. Mr. O'Connor protested against the suggestion that the price of gas should be advanced, and wished the report sent back to the Committee for reconsideration; but there was no seconder. Mr. Callan asked whether it was essential that fresh expenditure should be incurred. The Gas Manager (Mr. H. W. Saville) replied in the affirmative. For the size of their works, he said, they were selling the cheapest gas in Ireland. The Town Clerk remarked that in pre-war days the public lighting cost £600 a year; and for last year the charge—high prices notwithstanding—amounted to £322. The statement was adopted and the recommendations approved.

Meter Testing at Portsmouth.—Meters tested by the Portsmouth Corporation last year numbered 3880. Of these, 3462 were correct, 86 fast, 67 slow, 105 would not work, 71 were leaky, and 89 were rejected for various minor defects. Complaints from consumers numbered 126; and meter tests showed that 66 were correct, 40 were fast to an average extent of 5·3 p.ct., 15 were slow to an average of 6·1 p.ct., and 5 would not register.

Gas-Works Deficit at Bradford.—Referring to the financial position of the various trading concerns, in his "budget statement" to the Bradford City Council, Sir James Hill, Bart., M.P. (Chairman of the Finance and General Purposes Committee), said there was again a loss on the gas-works; the approximate deficit for the year being £25,000. The credit balance at the commencement of the year was £9500. Of this, there had been spent in the erection of vertical retorts £2000, leaving a balance of £7500. The net loss for the year, of £25,000, made the revenue account overdrawn by £17,500. A sum of £3000 had been charged to capital account during the year in respect of the vertical retorts, making a total expenditure of £1,257,000; and as the total amount repaid through the sinking fund was £561,000, there were at present outstanding loans upon the concern amounting to £696,000. In view of the very heavy increase in the price of coal and other expenses of production, the Committee must again take into consideration the necessity of increasing the price of gas.

Southampton Gas Light Company.

The proprietors of the Company at the half-yearly meeting unanimously adopted the report of the Directors, as appearing on p. 242 of last week's "Journal." The Chairman (Captain A. J. Corse Scott, J.P.) said the half year had been a difficult one; and there was a slight decrease in the total quantity of gas sold. The revenue account showed an increase in receipts of £8048, and in expenditure of £9043. Coal and oil cost £13,363 more than for the same period of 1915, principally due to the higher cost of freight and war risk insurance; and also to the enormous increase in the price of oil. To this must be added £780, which did not appear in the accounts, for additional payment on war risks, of which the Directors were not informed in time to include. In addition to the increased cost of raw materials, the employees had asked for an increase in the war bonus now received, which was 5s. per week. The Directors hoped shortly to arrive at a settlement which would be satisfactory to the employees, and enable them to carry out their duties with the same good spirit as in the past. But one and all must recognize that in these strenuous and abnormal times everyone must bear his or her part of the burden of carrying the war to a victorious end. The price now charged for gas by the Company was the maximum; and the increase in the cost of materials and labour would necessitate a call on the Company's reserve. But the stockholders must not think the Directors had no confidence in the future of the undertaking. So far as could be seen, the town and district supplied by the Company had a big future; and when the war came to an end, the Company would have a share of the prosperity that would ensue. This year the increase in the sale of gas had been abnormal. The number of employees now serving with the forces was over 180. The Directors were maintaining the allowances granted to the dependants of the men serving with the Colours. A War Savings Association had been formed with over 200 contributors; and the Directors had, in order to encourage thrift, rendered financial help.

Lisburn Maximum Price.—Following the recent Local Government Board inquiry in Lisburn, the Urban District Council have been informed that instructions have been given for the preparation of a Provisional Order to amend a clause of the Local Act, so as to enable the Council, if necessary, to raise the price of gas to 6s. per 1000 c.ft. The Council had applied for an extension of the 4s. limit to 6s. 6d.

Price of Gas at Coleraine.—A statement submitted at a meeting of the Coleraine Urban Council showed there was a loss on the year's working of the gas undertaking to March 31 last of £891. The amount paid for coal alone was £5027, as compared with £2394 in 1913; and the credit cash balance had been reduced to £467. In view of this state of affairs, the Gas Committee had no option but to recommend an increase in the price of gas to ordinary consumers from 4s. 7d. to 5s. per 1000 c.ft., and for power purposes from 4s. 2d. to 4s. 7d. The recommendation was agreed to.

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DEAD BEAT INDICATORS

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"READ THE PRESSURE BY THE POINTER."

No liquid to evaporate and no levels to adjust.

No glasses to break and nothing to clean.

Direct reading, Open scale, Any range (Pressure, Vacuum, or Combination).

Incorrodible, Accurate, For foul or purified gas.

MADE IN MANY RANGES WITH TABLETS LETTERED AS DESIRED.

ALEXANDER WRIGHT & CO., LTD., WESTMINSTER.

Agents: Australia—FYVIE & STEWART, 360, Collins St., Melbourne; Canada—W. P. ROPER, 502, Merchants' Bank Building, Montreal.

Gas Stoker and a Leaving Certificate.—The case of a stoker in the employ of the West Bromwich Gas Committee has just been decided by the Munitions Tribunal. The Manager (Mr. W. H. Johns) refused to give the man a leaving certificate; and he appealed to the Tribunal. The result was that the man was told he was employed in a certified trade; and as he was being paid the standard rate of wages, the Manager's decision would be upheld. He was ordered to return to his duties at the gas-works.

Suspension of Street Lighting in Bradford.—On the minutes of the Gas Committee being submitted by the Chairman (Mr. J. H. Barraclough) to last week's meeting of the Bradford City Council, Alderman Conway drew attention to a paragraph which stated that instructions were given for the discontinuance of public street lighting during May and "until otherwise ordered," having regard to the adoption of Summer Time and the necessity for the saving of coal. Alderman Conway proposed as an amendment that "until otherwise ordered" should be deleted, and that public street lighting should be discontinued during May, June, and July, and a report on the question be presented to the Council in July. He thought the Council were entitled to know before another winter came whether the conditions were going to be the same as during last winter. Mr. Barraclough accepted the amendment; and the minutes were adopted.

Low Temperature Carbonisation.—A Company having this title has been registered, as a private Company, with a capital of £100,000 in £1 shares, for the purpose of carrying on business as distillers, extractors, producers, manufacturers, and suppliers of all solid, liquid, and gaseous substances or matter in any manner derived from coal or from the derivatives of, or residuals obtained from, coal. Mr. Harold I'Anson Jones is Solicitor to the Company, the address being given as No. 62, London Wall, E.C. 2.

Dudley Employees and Exemption.—At the Dudley Tribunal last Thursday, Mr. W. H. Thompson appeared to support an application by the Dudley Gas Company, who asked for exemption for five of their employees. Two were gas stokers; the others were engaged as winter stoker, &c., assistant gas-fitter, and works handy man and purifier and retort-house man. All except one of them were married. It was stated that, owing to the scarcity of stokers, the gas was very poor last winter; but the Company were now improving it. For the last three months, the Company had been applying to the Ministry of Munitions for permission to put down new plant; but so far they had received no definite reply. If they could not have the new plant, they would have to reduce their output by 2,000,000 c.ft. per week. Three of the men were granted exemption until Aug. 15; but the appeals of the winter stoker and one of the gas stokers were dismissed.

STOCK MARKET REPORT.

THE past week has been rather less favourable to the Stock Exchange; markets of many and various descriptions being under a cloud, which persistently brooded over them day after day until almost closing time, when some signs of lightening were, happily, to be descried. The march of events in Russia, which tended to give rise to much apprehension, was responsible for this state of affairs. The antagonisms and rivalries of conflicting democratic sections are difficult to follow with such limited information as reaches us; but it may be safely predicted that internal disunion, if persisted in, may bring about the re-establishment of Imperial despotism. Of war factors there was a dearth; but big victories cannot be expected every week.

The Government issues (the War Loan and Consols) were both firm, and closed steady; but in other directions, the array of Colonial loans, actual and expectant, bore heavily. Americans were very undecided, oscillating almost from day to day, and Canadians looked rather steadier on Friday. Argentines were no better; local conditions not being conducive. South Africans were quieter and less buoyant. The Foreign Market also was a sufferer; the flatness of Russian issues taking much of the brightness out of it, and French loans moving somewhat unevenly. On the other hand, improved conditions in Brazil had their effect, and Chilian was in some demand.

Business in the Gas Market was rather fitful—fairly active one day, and quite quiet the next—and altogether the aggregate only bulked rather below the average. However, the quietude did not affect the strength of the market, and the prices realized were in many instances advances upon the preceding week. Higher quotations were marked in issues of Gas Light and Coke, South Metropolitan, Southampton, Oriental, Monte Video, and Cape Town. Primitiva was steady, and Imperial Continental was two points down. In the Money Market, rates ruled firm at first, but became easier later on.

Bargains done for cash during the week were as follows: On Monday, Bombay 5, Brighton and Hove "A" 104½, British 33⅛, 33⅜, 33⅝, European 12 9/16, 12⅝, Gas Light ordinary 72, 72⅜, 72½, 72⅝, Imperial Continental 81, 81½, 82, Oriental 106, 106½, Primitiva 40s., 41s. 3d., ditto preference 65s., 65s. 7½d., South Suburban 76¾, Tottenham "B" 69½, 70½. On Tuesday, Gas Light 10 p.ct. bonds 170, 171, Imperial Continental 80, 81½, Oriental 106, Primitiva 41s. 3d., ditto preference 62s. 6d., San Paulo preference 8 3/32, 8⅛, South Metropolitan 77⅜, 78½. On Wednesday, Cape Town 1⅜, Gas Light ordinary 72½, 72⅜, 72⅞, Primitiva 42s. 6d., 43s. 6d., ditto preference 62s. 6d., South Metropolitan 78½, 78⅝, Waltham Abbey "B" 7⅞, 7 15/16. On Thursday, Bournemouth debenture 71⅛, 71⅝, Commercial 4 p.ct. 72½, 73½. 74, Continental Union preference 59, European 12½, 12 13/16, Gas Light ordinary 72, 72½, 73, ditto debenture 56¾, 57¼, ditto 10 p.ct. bonds 170, 170½, Imperial Continental 80, 81, Monte Video 8¼, 8 5/16, Primitiva 42s. 6d., ditto preference 60s., 65s., South Metropolitan 77½, 78, 78½. On Friday, Commercial 4 p.ct. 73½, 74, Gas Light ordinary 73⅛, Imperial Continental 80, South Metropolitan 78, ditto debenture 56, Tottenham "B" 70½.

The Bank rate is 5 p.ct., as fixed on April 5.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend and Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	58—63	..
1,551,868	,,	April 8	2½	5%	Alliance & Dublin Ord.	59—64	60—62	..
874,000	,,	July 10	4	4%	Do. 4 p.c. Deb.	76—79	58—63	..
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5⅞—6⅛	5—5½	5
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water (10 p.c. B 7 p.c. Pref. 6 p.c. 4 p.c. Deb.	29—30	24—26	..
389,110	10	,,	7	7/-		15—15½	10⅞—11¼	..
115,000	10	,,	6	6/-		13½—14	9¼—9⅝	..
159,740	—	—	—	4%		..	71—73	71⅛—71⅝
992,045	Stk.	Feb. 26	14	55/-	Brentford A Consolid.	261—266	83—85	..
731 920	,,	,,	11	53/9	Do. B New	204—209	80—83	..
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	83—88	..
221.400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91—93	67—69	..
217 380	,,	Feb. 26	11	10%	Brighton & Hove Orig.	208—213	150—155	..
244,200	,,	,,	8	7%	Do. A Ord. Stk.	154—159	102—107	101½
530 000	20	Mar. 26	12½	22/6	British	44—45	33—34	33⅛—33⅜
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	66—68	..
245.771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	57—60	..
100.000	10	—	—	—	Cape Town & Dis., Ltd.	1⅛—2⅛	1⅛—2	1⅛
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	5—5½	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	..
157.150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	79½—80½	..
1,513,280	,,	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	72—74	72½—74
560 000	,,	,,	5½	46/8	Do. 3½ p c. do.	103—105	65—68	..
475 000	,,	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	52—54	..
800,000	,,	,,	4	—	Continental Union Ltd.	76—79	38—40	..
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	58—60	59
278,400	—	—	—	11½%	Croydon B and C 7 p.c..	..	170—180	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5½%	Derby Con. Stk.	123—125	95—100	..
55,000	,,	—	4	4%	Do. Deb. Stk.	103—104	80—83	..
1,032,180	10	July 29	10	7/6	European, Ltd.	17½—18	12—13	12½—12 13/16
16 313 430	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke (4 p.c. Ord. 3½ p.c. max. 4 p c Con. Pref. 3 p.c. Con. Deb. 10 p.c. Bonds	98—102	74—74	72—73½
2,600 000	,,	,,	3½	3½%		76—79	56—58	..
4,062,235	,,	,,	4	4%		93—93	72—74	..
4,674 850	,,	June 11	3	3%		72½—74½	56—58	56⅞—57½
130 000	,,	,,	10	10%		..	..	170—171
2 8,740	,,	Mar. 12	5	4½%	Hastings & St. L. 3½ p.c.	87—89	76—81	..
70 000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16⅝	8—9	..
86,600	—	—	—	9½%	Hornsey 7 p.c..	..	120—130	..
131,000	Stk.	Mar. 12	7½	7½%	Ilford A and C.	151—154	102—107	..
65,780	,,	,,	6⅜	5½%	Do. B	115—118	80—85	..
65,500	,,	June 26	4	4%	Do. 4 p.c. Deb	92—94	71—74	..
4,910,000	,,	May 14	9	4½%	Imperial Continental	150—160	80—85	80—81½
1,235,000	,,	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	62—65	..
235,242	,,	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p c.	119—121	85—90	..
2,498,905	,,	Feb. 26	10	5%	Liverpool 5 p.c. Ord. A	211—213	..	..
					B	146—148	82—84	..
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	72—74	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	3⅝—4½	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	88—98	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8½—8⅞	8½—8 5/16
1,875,892	Stk.	July 29	4½	4½%	Newcastle & Gateshead Con.	98½—99½	70—70½	..
529,705	,,	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	73—75	..
55,940	10	Feb. 26	7/14/0	7/-	North Middlesex 7 p.c..	14—15	10—11	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	104—106*	106—106½
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅞	2—3	..
60.000	50	Feb. 26	13	12½%	Portsea, Island B	128—131	92—97	..
100,000	50	,,	12	11%	Do. C	118—121	85—90	..
52,000	50	,,	10	9%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	2—2½	40/—43/6
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4½—5	3—3½	60/—65,7½
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	78—80	..
—	—	—	—	4%	Do. ,, ,, 1911	..	..	..
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	61—67	..
150,000	10	May 14	6	6/-	San Paulo (6 p.c. Pref. 5 p.c. Deb.	10½—11	7⅞—8½	8⅜—8⅝
125,000	50	July 1	5	5%		47—49	42—44	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—224	1 5—180	..
200,984	,,	,,	10	10%	Do. B	22.—224	175—180	..
523 500	,,	,,	10	10%	Do. C	220—222	175—180	..
50,000	10	May 28	9	6/-	South African.	10½—11½	..	..
5,603,895	Stk.	Feb. 10	5/4/0	46/8	South Met. 4 p.c. Ord.	111—113	77—79	77½—78½
1,895,445	,,	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	56—58	56
224,820	,,	Feb. 26	8½	8%	South Shields Con. Stk.	157—159	140—142	..
954,795	,,	,,	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	7 —78	76½
60,000	,,	,,	5	5%	Do. 5 p.c. Pref.	110—112	77—79	..
125 000	—	—	—	48/4	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p c. Deb. Stk.	116—118	88—90	..
647,740	,,	May 14	5	5%	Southampton Ord.	99—102	76—78*	..
120.000	,,	Feb. 12	7½	7½%	Tottenham (A 5 p.c. B 3½ p c. 4 p.c. Deb.	125—128	95—100	..
782,275	,,	,,	6	5⅝%		115—117	68—73	69½—70½
181 255	,,	June 26	4	4%		87—89	65—67	..
182 380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p c. max..	108½—109½	89—91	..
30,000	,,	Feb. 26	8⅜	80/-	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c..	151—156	114—119	..
255 636	,,	,,	6¼	65/-	Do. B 3½ p.c.	129—134	99—101	..
108,075	,,	,,	5/17/8	56/-	Do. C 3½ p.c.	110—115	86—91	..
352,000	,,	,,	6¼	58/9	Wimbledon 5 p.c.	117—122	88—93	..
98,000	,,	,,	6⅜	65/-	Epsom 5 p.c.	121—126	96—101	..
88,416	,,	June 26	3	3%	3 p.c. Deb. Stk.	66—69	51—54	..

* Ex. Div.

Price Reduced at Middlesbrough.—The Middlesbrough Town Council have decided to reduce the net price of gas from 2s. 2d. to 2s. per 1000 c.ft. The Corporation are, of course, utilizing coke-oven gas for the supply to consumers for all purposes.

The Rapid Distillation and Power Company has been registered with a capital of £1,010,000 in £1 shares. The objects of the Company are to carry on the business of engineers, electricians, machinists, chemists, mineowners, importers, exporters, and manufacturers of, and dealers in, oils, chemicals, merchandize, and produce, garage, store, and warehouse keepers, &c.

Dublin Gas Lighting.—Gas lighting interests in Dublin should be favourably affected by the rebuilding of the area destroyed during last year's rebellion, in connection with which the Treasury are expected to release very soon a sum of £100,000. In most, if not all, of the new business houses there will be ample scope for the introduction of the latest methods of gas illumination; and it is understood that several contracts are already in process of arrangement. Temporary buildings erected by some of the firms concerned, and one or two new permanent buildings which have been finished, show that the incandescent system is fully appreciated.

Conditional Exemption Withdrawn at Southport.—At the Southport Tribunal last Thursday, the Military Representative (Alderman Willett) applied for the withdrawal of the certificate of exemption granted to Philip H. Christian, aged 33, married, passed A, and employed as an Outdoor Superintendent of the Southport Gas Department. The Military Representative said his attention had been specially called to this man by the military authorities on account of his age, and because he was passed for general service. Mr. John Bond (the Engineer) said that, owing to the loss of their Chief Chemist, who joined up, this man was called upon to do a certain amount of scientific work, and had been called upon to relieve to a great extent the stoppage which had occurred through the deposits occasioned by the extraction of certain elements for military purposes from the gas. The man was not exempted by the Ministry of Munitions. The certificate was withdrawn, and temporary exemption was given to Aug. 1.

The Brighouse Town Council have decided to place the whole of the profits of the gas undertaking to the reserve fund.

The Hull Corporation decline to join Newcastle [*ante*, p. 154] in asking the Government to amend the Sale of Gas Act, 1859.

The Strathaven Gas Company have given notice that the rent of meters has been doubled. It is stated that meters have increased in price, and are difficult to get.

Following an electric illumination, fire broke out in the city hall at New York, and burned for an hour before it was got under control. The conflagration is suspected to have arisen from defective wiring.

Protests have been entered against the Limerick Corporation's decision to reduce public gas lighting from now until the middle of August in such a way as will, it is contended, cause great inconvenience to the citizens—leaving a large area in complete darkness throughout the night.

Manchester ironmongers have arranged to have made for them a supply of upright and inverted mantles, bearing their special mark—"M. & D. Ironmongers." As the result of a discussion as to the propriety of making a fixed price for the mantles, it was agreed to have one price for all the members of the Association.

In consequence of the increasing scarcity of coal and oil in Denmark, says "The Times," theatres will be open only three days a week, and street lighting will be abolished; while the use of oil for lighting will be prohibited.

Very complimentary remarks were made as to the appearance of cart-horses and motor vehicles at the annual May-day parade of the transport workers of the Aldershot Gas, Water, and District Lighting Company. At the conclusion of the judging, Master R. W. Edwards, son of the General Manager, distributed the prizes, after which the vehicles paraded the streets before returning to work.

General licences permitting for the present the importation into the United Kingdom of certain articles falling within the agreed definition of "Hardware," which are specified in a published list, have been revoked. It may, however, be understood that goods in transit direct to the importers before May 15 will be admitted under the general licences now withdrawn. The list includes gas or oil burners and iron gas-burner castings for stoves.

The Fletcher Russell Rifle Club (which began two years ago with a membership of about eighty) are to be congratulated on having taken their place at the head of the Second Division of the Liverpool Miniature Rifle Association, which they joined last winter. The Fletcher Russell Club were easy winners—finishing the season with 38 points, as against the 32 points each of the four teams nearest to them. Mr. W. Leach is Hon. Secretary of the Club.

The Silsden District Council have decided that, as the Belgians in the district have now been there long enough to have settled down, and are well employed, and are even yet living rent free in many cases, it is time the supply of gas and water free of charge ceased. It was pointed out that the Belgians were self-supporting now, and were in a better position than many of the town's own people. From July 1, therefore, the Silsden Belgians will be charged for gas and water.

Those desiring a thoroughly well secured investment will find it in an issue of £10,000 of 5 p.ct. redeemable mortgages which Messrs. A. & W. Richards are (with the sanction of the Treasury) offering by tender on behalf of the Directors of the Croydon Gas Company. The minimum price of the mortgages (which will be redeemed by the Company at par on June 30, 1923) is £96 per £100; and, allowing for redemption, they show at this price £5 16s. 3d. p.ct. It will be seen from the advertisement which appears on another page that tenders are to be sent in by Thursday morning, the 24th inst.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral Countries unless they are posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "Journal" has obtained the required permission of the War Office; and he will, on receipt of instructions forward copies direct from the office to any neutral country.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Engineer, Manager, and Secretary. Northallerton Gas Company. Applications by June 8.

Assistant Manager. Leeds Gas Department. Applications by May 22.

Manager. No. 6309.

Man for Dehydrating and Toluol Plant. Aylesbury Gas-Works.

Waste Water and Tap Inspector. Wombwell Urban District Council. Applications by May 28.

Plant, &c. (Second Hand) for Sale.

Gas Engine (17½ h.p.) Great Northern Railway Company (Ireland). Tenders by May 28.

Retort Pieces. Newport (Mon.) Gas Company.

Sulphate of Ammonia Plant. Newton-in-Makerfield Gas Undertaking.

Plant, &c. (Second Hand) Wanted.

Gasholder. No. 6308.

Gas-Steam Radiators. No. 6310.

Sale of Mortgages.

Croydon Gas Company. Tenders by June 30.

Gas-Works for Sale.

No. 6305.

TENDERS FOR Coal.

Dawlish Gas Company. Tenders by May 31.

Oswaldtwistle Urban District Council. Tenders by May 31.

Stretford Gas Company. Tenders by May 22.

Tiverton Town Council. Tenders by June 2.

Torquay Gas-Works Committee. Tenders by May 21.

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For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT

GAS PURIFICATION & CHEMICAL CO., LD.,
Palmerston House,
Old Broad Street, London, E.C.

"VOLCANIC" FIRE CEMENT.
Resists 4,500° Fahr. Best for Gas-Works.
Andrew Stephenson, Gresham House, Old Broad Street, London, E.C. "Volcanism, London."

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, Oldham, and 45 & 47, Westminster Bridge Road, London, S.E.

WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.

Repairs receive prompt attention.
Telephones: 815 Oldham, and 2412 Hop, London.

Telegrams—
"Braddock, Oldham," and "Metrique, Lamb London."

SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—

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89, Victoria Street, Westminster, S.W.

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Tins for sale to Consumers.
In Bulk for Works Use.

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